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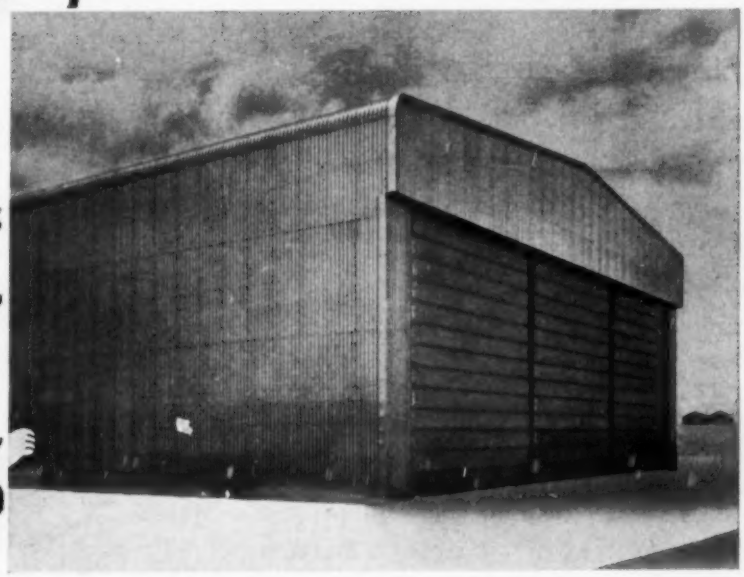

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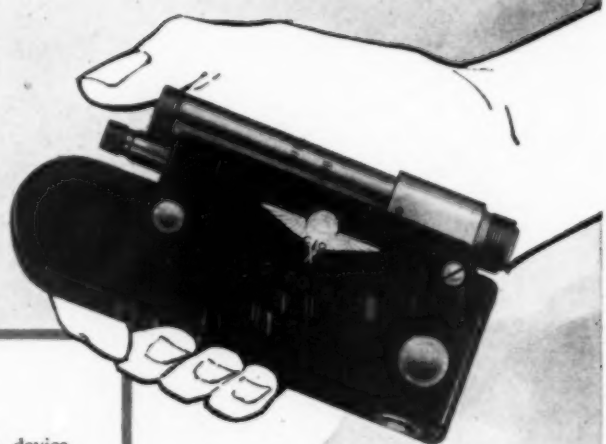

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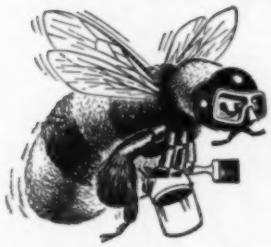

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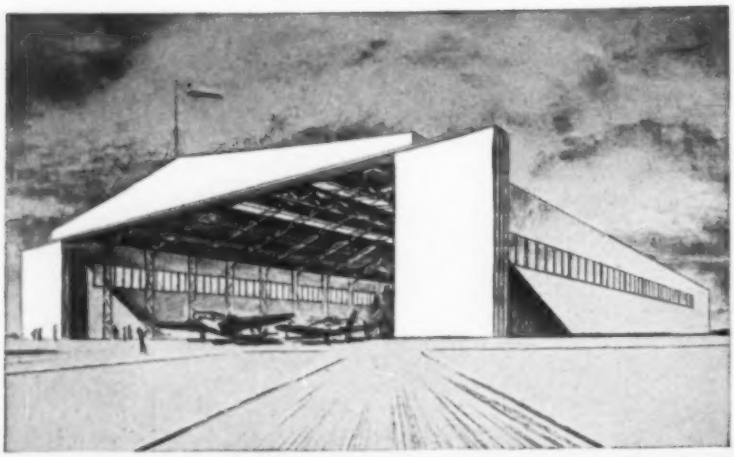

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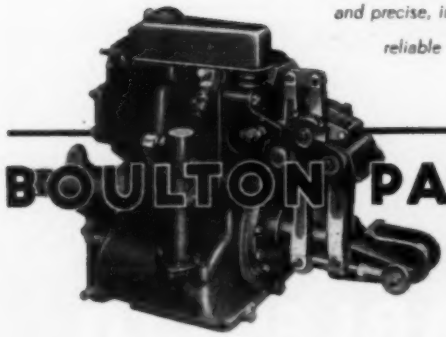

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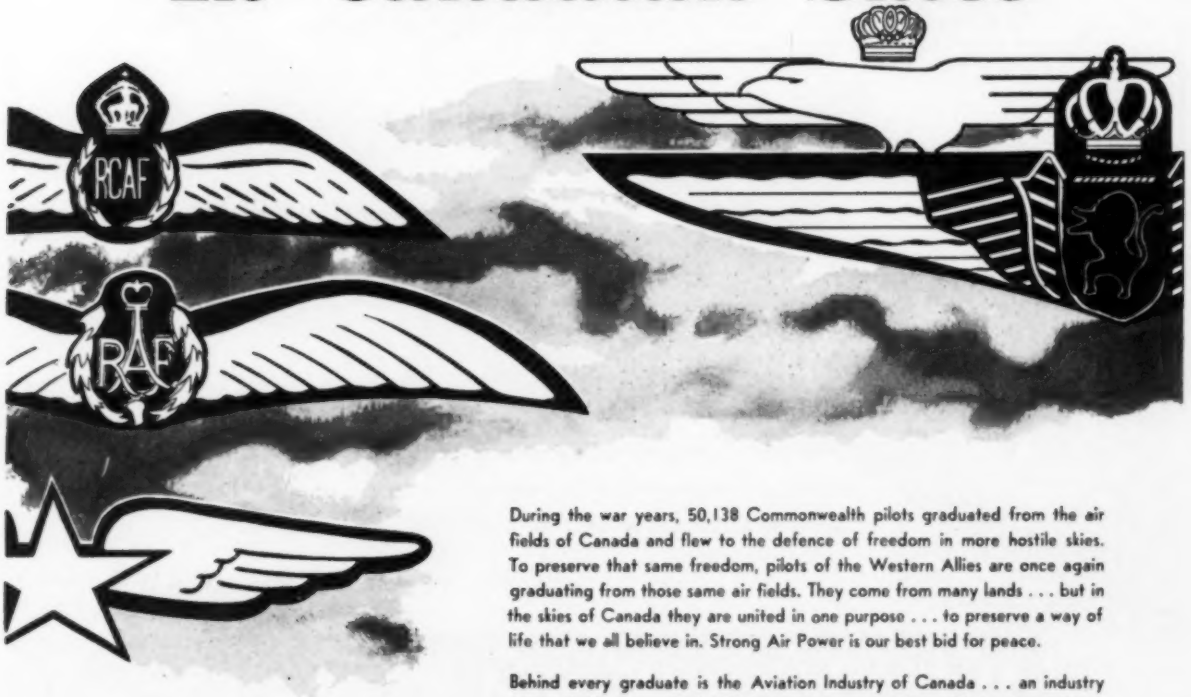

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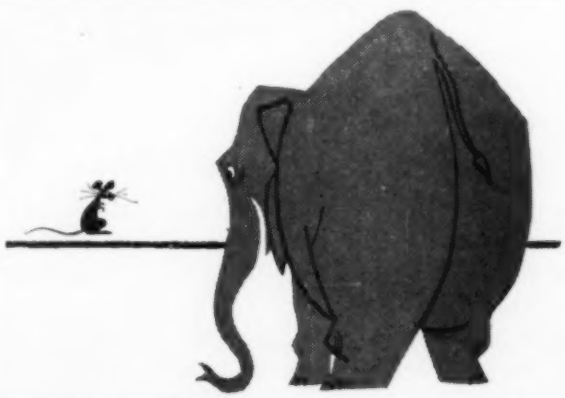

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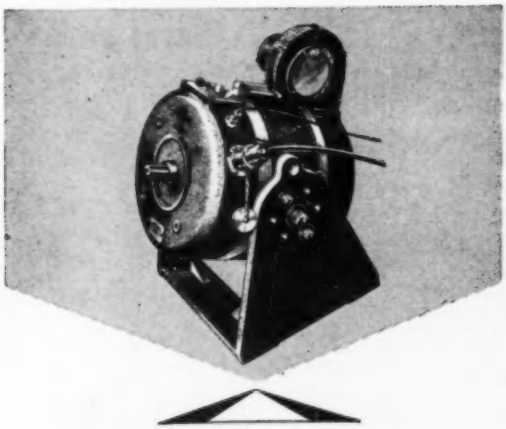

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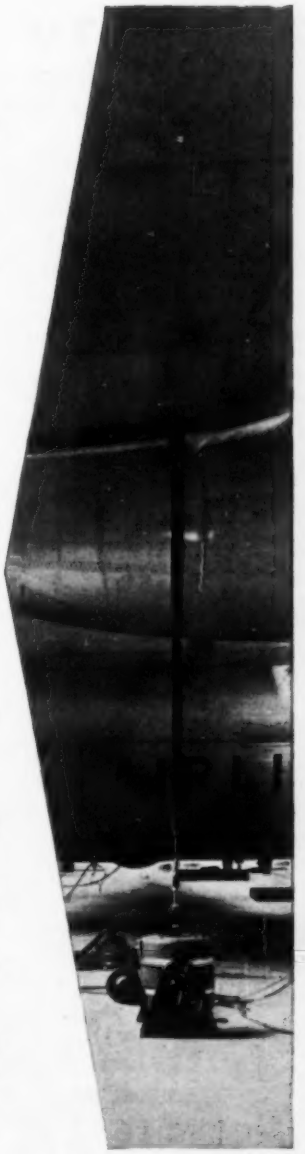

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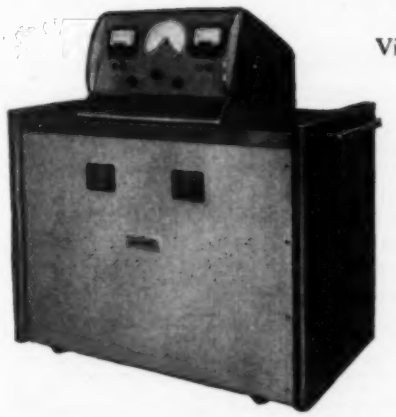

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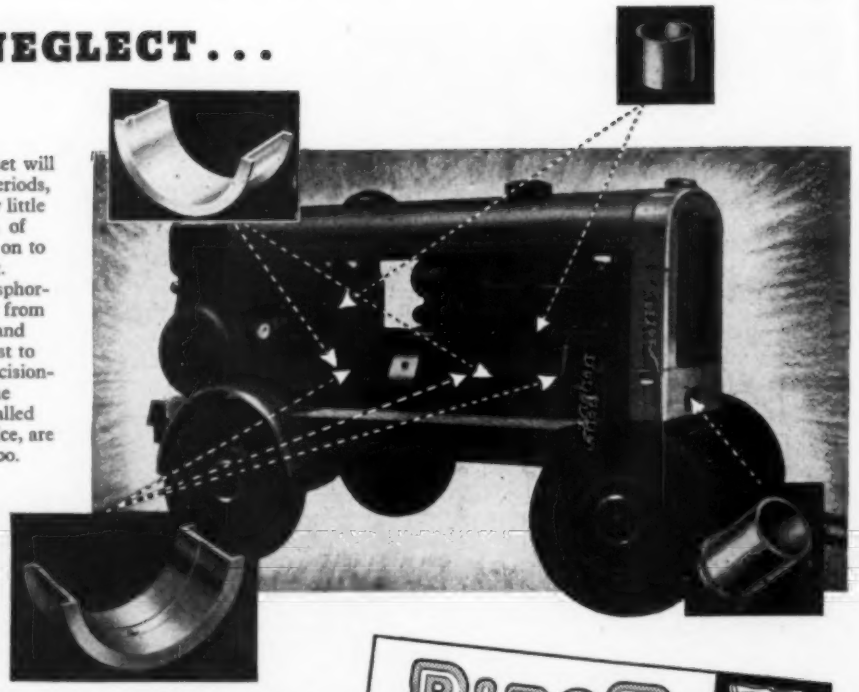

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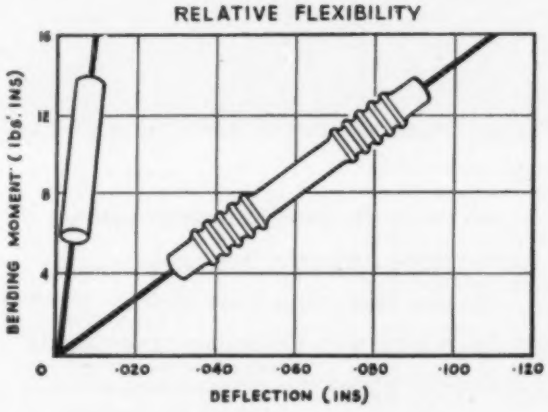

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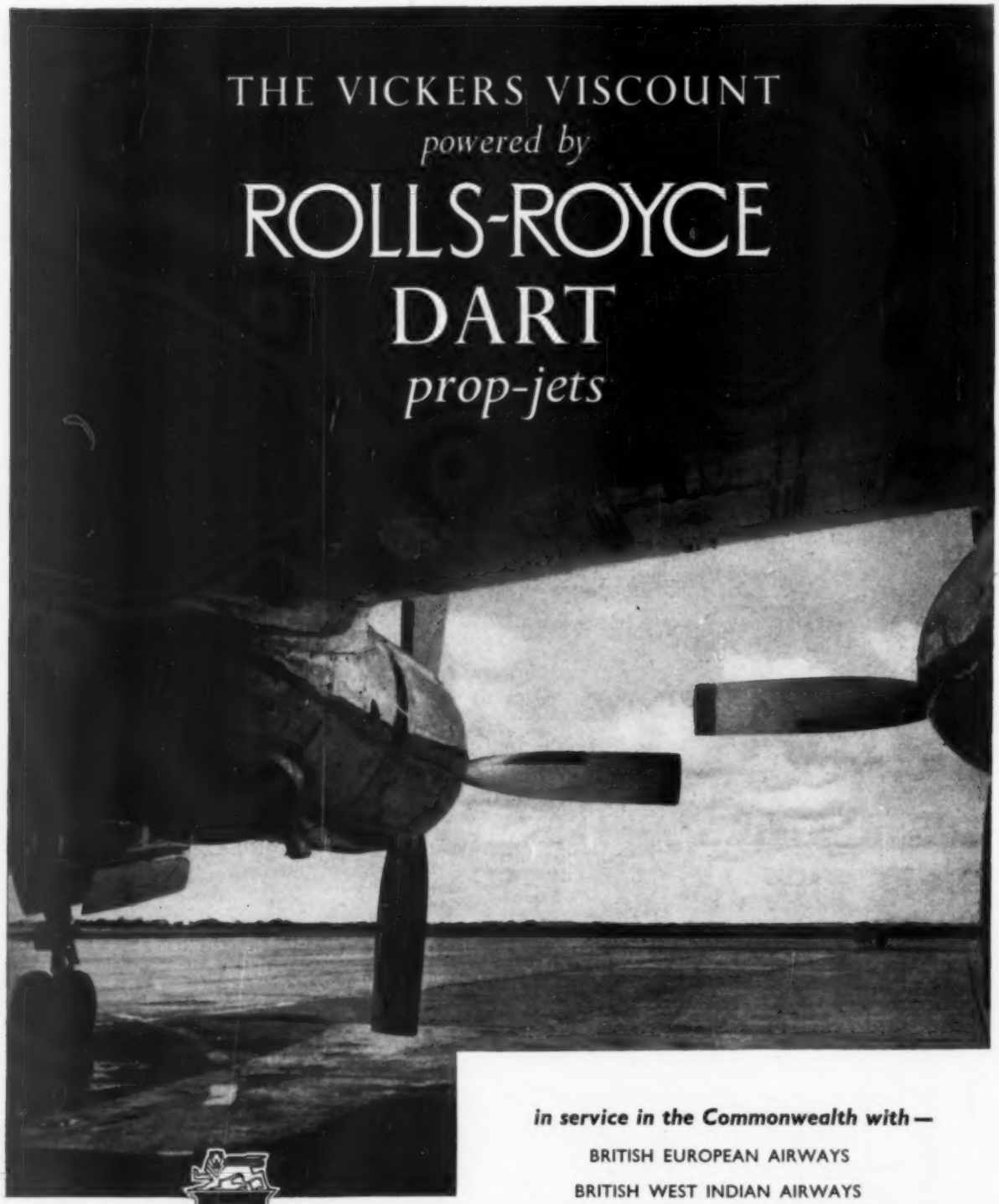

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FLIGHT
and
AIRCRAFT ENGINEER

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A Policy for British Air Transport

IN their widely publicized special report, the Air League of the British Empire proposes sweeping changes to British air transport (see page 243). By coincidence, the report appears at the same time as Sir Roy Fedden's appeal for urgent action at the highest level to ensure Britain's future as a civil and military air power. His book, *Britain's Air Survival*, is reviewed in this issue.

The Air League's special committee, with Sir Miles Thomas as chairman, restricts its terms of reference to civil air power. Nevertheless its scope is far-ranging—so much so that some of the proposed solutions to the well recognized problems appear to be none too strongly founded. But the real significance of the report is the very fact that it has been attempted. Though some may scoff, and even burst a blood vessel, at certain of the proposals, the findings of these enthusiastic, experienced and distinguished men truly reflect the deep stirrings of disquiet about the nation's civil air power. The report, like Hamlet, is in effect saying that diseases desperate grown by desperate appliances are healed, or not at all.

This is the light in which to assess those sections of the report which appear to be the least firmly based. Take, for example, the proposed supersonic airliner (see photograph on page 243) with which Britain could "regain the blue riband of the Atlantic, increase enormously our aircraft export market, and under the new Defence Policy be in a position to marshal our military forces anywhere."

With the greatest respect for the technical brilliance of the concept we suggest that it would be a mistake for the transport-manufacturing industry during the coming ten years to divert its attentions from the more conventional aircraft business—which even the Air League report recognizes may be valued at £5,500 million. The world's airlines will not be ready in 1970, except possibly to a limited, government-subsidized extent, to use such exorbitantly costly tools.

We do *not* imply that there should be no Government support for research into such a visionary and imaginative scheme; but we do suggest that £75 million of public money spent on riband-chasing for its own sake is not the way to become a great civil air power. It could so easily lead to repetition of past mistakes. There are markets to be won and British operators to be equipped with more conventional aircraft. And there are long-term technical developments—supercirculation and laminar flow among them—to be applied to the improvement of conventional jet and turboprop machines of all sizes.

In discussing the ability of the two British airline Corporations to handle traffic which may double itself twice in the next decade the report examines the relationship between the size and efficiency of an airline. It concludes, on the strength of a study by the airline economist Mr. S. F. Wheatcroft, that the Corporations "may well in the course of a few years have reached a stage where they will have become unmanageably large." The Wheatcroft study showed that an airline's cost of operation appears to stabilize at an annual output of 200m capacity ton-miles. But it did not indicate that costs rise beyond this output. Is it, in fact, being suggested that airlines should, like the amœba, indulge in binomial fission as their sizes increase? There may be good grounds for giving the private airlines (and their shipping associations) a bigger slice of Britain's international air commerce—but not on this basis.

The report's soundest recommendations concern the Air Transport Advisory Council and the Minister of Transport and Civil Aviation. It is suggested that the responsibilities of the first be extended and those of the second concentrated. The A.T.A.C., recommends the report, should be a regulating board with a constitution more closely resembling that of the U.S. Civil Aeronautics Board. The Minister, with Cabinet status, should be charged exclusively with the co-ordinated development of British air transport. Certainly we often find ourselves wondering how our present Minister, with his roads, ships, railways and canal barges, manages to keep as closely in touch with the air as he does.

FROM ALL QUARTERS

Decca in Canada

AT a ceremony in Halifax, Nova Scotia, last Monday, the Nova Scotia chain of Decca Navigator stations was officially inaugurated by Mr. George Hees, Canadian Minister of Transport.

The system is now rapidly being established in Canada. The first two chains, Newfoundland East and West, are on test by the Department of Transport; the Nova Scotia chain, referred to above, is in operation; and the fourth chain, covering the Quebec area, is scheduled to be on the air by October. Each of the four will give continuous high-accuracy coverage over an area of a quarter of a million square miles, and they will also be associated with the North Atlantic coverage of the long-range aid Dectra.

Decca Doppler, announced on page 250, will be the next step in this integrated system.

Orpheus Lockheed

SEPTEMBER 4 is given by Lockheed Aircraft Corporation's California Division as the most probable first-flight date for the CL-329 utility transport. Powered in prototype form by two Bristol Orpheus turbojets, the CL-329 is likely to go into production with four General Electric J85 engines and is expected to incorporate boundary-layer control.

The Farnborough Programme

SIX—possibly seven—aircraft never seen before at a display, two world record holders and three new flying test-beds are likely to appear at the Farnborough Show, according to an advance programme issued by the S.B.A.C. Three (or perhaps four) of the aircraft will be capable of speeds in excess of 1,000 m.p.h.

Newcomers are the Westland Wessex, Aviation Traders Accountant, Miles H.D.M. 105 and M.100 Student, English Electric P.1B, Avro Vulcan B.2 and, possibly, the Saunders-Roe SR.53 intercepter. New engine test-beds include the Spectre-Canberra, Gyron Junior-Canberra and Conway-Vulcan.

Flying will begin at 2.30 p.m. on the private days (September 3-5) and at 3 p.m. on the public days (Friday-Sunday, September 6-8). A Gannet T.5 trainer will lead the first "circus" of aircraft, which will include a Canberra B.8; a Hunter with reverse thrust; a Britannia (appearing on the private days only) fitted with an Orion, a Proteus 755 and two 705s; an Olympus-Canberra; and the Scorpion-Canberra, which recently returned from Tripoli.

Next, helicopters will be demonstrated: Westlands will fly the Wessex, two Whirlwinds and a Widgeon; Bristols a Sycamore and a 173; Faireys two Ultra-Lights; and Saunders-Roe a Skeeter fitted with Napier blade-tip rocket boosters.

Three airliners and a Service transport will then take off, carrying invited guests. First away will be the Comet 3, which will be airborne for about five minutes. A Twin Pioneer, a Herald and Pembroke will leave the circuit and return half an hour later. Individual demonstrations follow. The Accountant will fly past (on two of the private days only); and the H.D.M. 105 will perform in company with the Student. These two new types will be followed by a Jet Provost, a Gnat and a Javelin.

A quintet of Hunters—T.7, a 4 and three 6s—will show their paces, the single-seaters variously equipped with drop tanks, bombs and guided missiles. They will be followed by the Scimitar Victor and—shown for the first time—the prototype Vulcan B.2.

Two versions of the P.1 will fly, the 1A and 1B, to be followed by the record-breaking F.D.2. The SR.53, says the S.B.A.C., *may* be there to form a fitting climax to the flying programme.

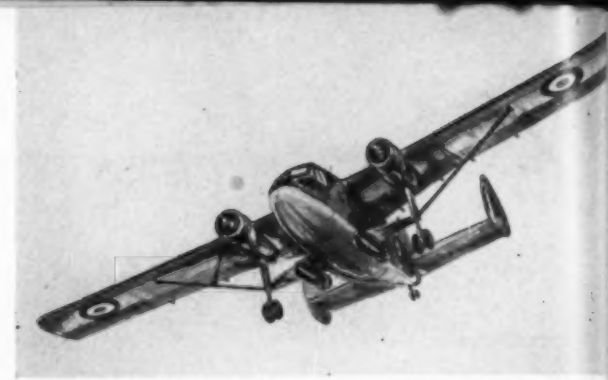
Flight understands that aircraft from Fighter, Bomber and Flying Training Commands are likely to present the R.A.F. contribution to this year's display, with Hunter and Provost aerobatic teams representing Fighter and Flying Training Commands. The Fleet Air Arm will be represented by 12 Gannets, five Sea Hawks, and Whirlwinds.

Admission details for the three public days are as follows:—

Friday, September 6: Adults, admission, 20s; children (under 14), 10s; private cars parking fee, 20s; motor coaches, 20s; motor cycles, 5s; pedal cycles, 2s 6d.

Saturday and Sunday, September 7 and 8: Adults, 5s; children (under 14), 2s 6d; private cars (inclusive of up to six occupants), 30s; motor coaches, 10s; motor cycles, 2s 6d; pedal cycles, 1s.

Tickets can be obtained at the gates (which are opened at 10 a.m.) on each of the public days; but for Friday, September 6—and for Friday only—they may be purchased in advance from Auto Parks, Ltd., 1 Maclise Road, London, W.14, or through the usual agencies.



SUBSONIC BOMBER: A "Flight" artist's impression of the Scottish Aviation Twin Pioneer in R.A.F. uniform—carrying two 1,000lb bombs.

Appointments and Promotions

SEVERAL new appointments—one in a Ministry of Supply establishment and others in the aircraft industry—have been announced during the past week.

Mr. J. Cushny, formerly an assistant director, has been promoted to director (engineer) and appointed Chief Engineer at the R.A.E. Farnborough.

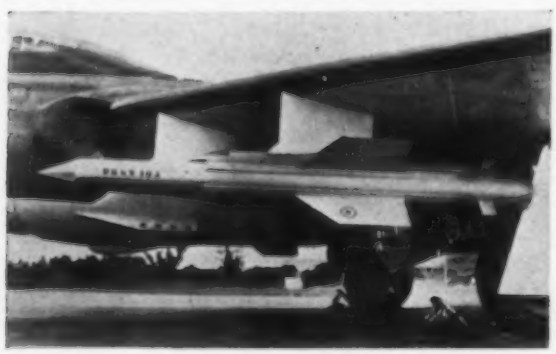
Mr. W. D. Rennie, chief accountant of the de Havilland Aircraft Co., Ltd., has been appointed secretary of the company, to which he transferred last year from the de Havilland Engine Co. He had previously (from 1947 to 1950) been secretary and chief accountant of Blackburn (Dumbarton), Ltd.

From Filton comes news of two changes at Bristol Aero-Engines, Ltd. Formerly chief accountant, Mr. F. M. Burns has been appointed to the Board in the newly created position of financial director; and Mr. D. Railton—since 1952 personal assistant to the present chairman of the Bristol Aeroplane Co., Ltd., Sir Reginald Verdon Smith—has been made secretary of the engine company.

Two new directors of Smiths Aircraft Instruments, Ltd., were named recently, Mr. A. M. A. Majendie, M.A., A.F.R.Ae.S., F.I.N., and Mr. L. C. Harman joining the Board with effect from August 1. Mr. Majendie joined Smiths in 1954 from B.O.A.C. and has been closely connected with the development of the Smiths Flight System. In B.O.A.C., which he joined in 1946, he was flight captain of the Comet fleet. Mr. Harman joined the accounts department of Smiths in 1924 (portraits, p. 252).

As we go to press we learn that Mr. Ernest Ower has been appointed chairman of Teddington Aircraft Controls, Ltd.

STANDARD ARMAMENT for the Sea Vixen, Javelin and P.1 will be the de Havilland Firestreak missile, seen here installed on a Sea Vixen.



"FLIGHT" AND FARNBOROUGH

THIS issue is the first of the four *Flight* special numbers published annually at the time of the S.B.A.C. Show. The remaining three are:—

August 30: "Britain's Aircraft Industry." A detailed, specially illustrated review of British aircraft, engines and components, including a quick-reference directory to aeronautical products and services.

September 6: "Farnborough Report." A first-hand report on the aircraft and flying demonstrations at the opening of the show, illustrated with *Flight* photographs.

September 13: "Farnborough Review." The rest of the show-week news, together with a further survey of technical innovations, illustrated by *Flight* photographs and drawings. Regular features will appear in this and the other Farnborough numbers.

Demand for these enlarged special issues is likely to be even heavier than usual, so advance orders to newsagents are strongly advised. Next week's (August 30) very big issue will sell at 2s. 6d., the other two at the normal price of 1s. 6d.

The Air League and Air Transport

Special Committee's Proposals for Extensive Changes in British Commercial Aviation

WE summarized last week the main recommendations of the special committee appointed last April by the Air League of the British Empire "*to formulate a comprehensive air transport policy to ensure that this country shall not only attain a share of world air traffic corresponding to its prestige and its needs as a great commercial nation, but shall also be equipped with the maximum reserves of air transport which can be available in case of war or similar emergency.*" The chairman of the committee was Sir Miles Thomas, D.F.C., M.I.Mech.E., M.S.A.E., former chairman of B.O.A.C. and now chairman of Monsanto Chemicals, Ltd.*

The committee consulted members of the Services and the Corporations, scientists, aircraft manufacturers and designers, travel agents, the independent operators (including the British Independent Air Transport Association), and "a considerable number of individuals having long experience in the air transport field as economists or in other specialist capacities."

The report begins by showing that the British share of world scheduled capacity fell from 5.3 per cent in 1951 to 4.2 per cent in 1956. Furthermore, the *rate* of increase was only 62.4 per cent compared with the world average of 80.2 per cent. (The report, however, acknowledges B.E.A.'s rate of increase, on the same basis, of 144 per cent.)

"It appears to us," says the report, " that it would be illogical to assume that the existing system would necessarily be the best to deal with the large expansion of traffic expected." It could be argued that the Corporations could carry the expanding traffic by expansion of their fleets, but "we found grounds for doubting if this by itself is the soundest policy or the most efficient method of meeting the entire expansion."

It had been suggested to the committee that there is an optimum size for an airline from the point of view of achieving maximum results, and that the Corporations had now reached this point. The report includes Mr. S. F. Wheatcroft's graph showing the relationship between operating cost and the size of an airline, which demonstrates that no advantage of size is gained when output exceeds 200 million capacity ton-miles. The committee had also been impressed by the prospect that two Corporations, if left to handle future traffic themselves, might in ten years' time be twice as large as all the United States domestic operators of today put together. The Corporations "may well in the course of a few years have reached a stage where their organizations will have become unmanageably large."

The committee points out that Britain's 21 private operators at present produce about 150 million c.t.m. per annum—about a third of the total production of the British air transport industry. They have 700 pilots and a total fleet which provides the country with a commercial asset that cannot be questioned. But the independents' business is mostly of a low-revenue type: in the charter field 65 per cent of business is trooping, which provides the principal source of the independents' revenue. Furthermore, "We were informed that 80 to 85 per cent of the independents' traffic, carried under licence in the case of passenger traffic, and under Government contract in the case of trooping, is on a basis of three years or less, with a substantial majority of one year or less. This is clearly an impossible basis for any commercial operation." The committee feels that the independents cannot long continue to exist under present conditions.

It therefore suggests a short-term and a long-term policy. Immediate ways of improving the independents' position might be found in more "fetching and carrying for all the Services and other Government departments." Much greater thought, the report states, could be given to the economic aspects of supply and demand by air transport as opposed to the maintenance of extensive stores overseas. "We doubt whether Service thought in this direction has got much further than comparing the actual ton-mile cost of transit by air, as compared with the sea, ignoring such considerations as that instead of provisioning spares on the basis of 100 per cent they could in many cases be provisioned on the basis of 25 per cent if air transport were employed." An investigation into this "important matter" might lead to great economies.

Next, more trooping traffic, half of which still goes by sea, could be carried by the independents. On the basis of recent experience the comparative costs of R.A.F. Transport Command and civil air transport might be in the ratio of three or four to one in favour of the latter. The true rôle of Transport Command as conceived by the committee "is the provision of heavy aircraft for the movement of the strategic reserve and its equipment from the main overseas air base concerned to the advanced air base to which it might have to be despatched for active service." As for the transport of personnel and equipment to the main overseas air base, this should be undertaken by civil air transport operators with aircraft like the Britannia.

As a step towards the long-term improvement of the independents' position, some of the independent operators should be brought into partnership with the Corporations, on the lines of the Australian and French systems. It might be, for example, that on a particular route the Corporation concerned should be allocated 50 per cent of the anticipated increase in traffic, and that an independent operator should be assigned the remainder. There would be "no real grounds" for the fear that this might undermine the position of the Corporations. The C.A.B., points out the report, allocates more than one operator to one route as a matter of course, and Air France operates in conjunction with five independent companies. The result of the French policy—half the traffic for Air France on long-range routes and 60 per cent on the shorter routes—is that the French independents are able to provide for the future and have ordered first-line aircraft including big jets.

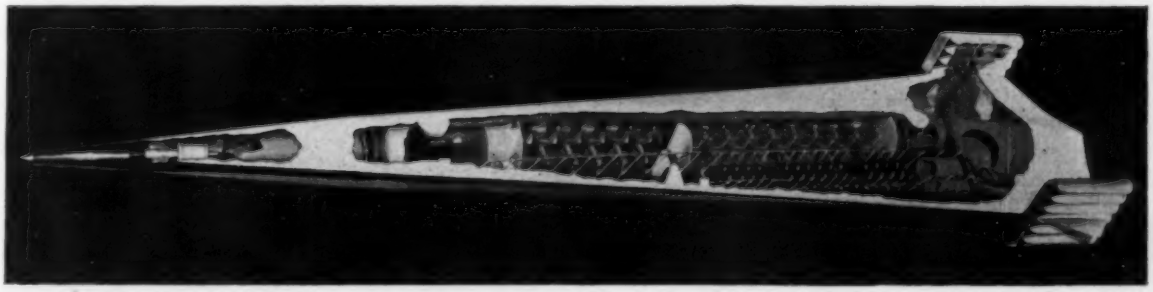
No mention is made in the report of the likely resistance by B.E.A. and B.O.A.C. labour to any proposal that would give private enterprise a bigger share of traffic, except "there must be no question of any changes within the Corporations which could dislocate their services or upset their staffs."

"Nowhere," says the report in discussing the need for better co-ordination, "is there anybody specifically charged with the duty of watching, co-ordinating and fostering the growth and development of the British aviation effort as a whole." Furthermore the functions of the Air Transport Advisory Council contrast with those of the U.S. Civil Aeronautics Board which, before any question of regulation, is charged with the "encouragement and development" of U.S. air transport. The report submits that the essential approach is "encouragement and development first, regulation afterwards." And the approach to this great question "must not be allowed to rest on a mere idea of taking advantage of natural growth." The A.T.A.C., it is suggested, should have its terms of reference extended more along the lines of

(*continued on page 248*)

* *The five committee-members were Mr. Ivor Bowen, C.M.G., M.Sc., F.R.Ae.S. (Air League Council member and from 1947 to 1950 chief superintendent of the A. and A.E.E. at Boscombe Down; since 1954 British Commonwealth representative in London of the General Precision Equipment Corp. of New York); Sir Wilfrid Eady, G.C.M.G., K.C.B., K.B.E. (director of Richard Thomas and Baldwins, Ltd., the steel manufacturers); Mr. Dennis Handover, M.Inst.T. (air transport consultant, formerly chairman of S.A.S.); the late Mr. R. V. Perfect (a director of Saunders-Roe); Air Chief Marshal Sir George Pirie, K.C.B., K.B.E., M.C., D.F.C., LL.D. (chairman of the Council of the Air League). The secretary of the committee was Mr. Frank Hillier, M.C., secretary-general of the Air League.*

A model of the Mach 2·6 transport referred to in the report. Based on the narrow-delta, VTOL principle conceived by Dr. Griffith of Rolls-Royce, it would have a battery of light, high-efficiency lifting engines (58 in this model of a 44-seat project) and multiple fin-installation for forward propulsion (12 in this model). The essence of the idea is very low structure weight. A 135-tourist passenger machine of this type, suggests the Air League, could be built by 1970 to fly from London to New York in 2½ hr. Gross weight would be "around 200,000lb, with a payload and fuel capacity of about half that weight." The project might cost the country £50 to £70 millions. "Flight" photograph



HERE AND THERE

PILOTLESS, this Kaman HTK-1 made the worlds' first crewless radio-controlled helicopter flight from Bloomfield, Conn, recently. Because of regulations governing robot aircraft, the aircraft was tethered by several hundred feet of rope.

Showing the Flag

THE No. 111 Squadron aerobatic team of five black-painted Hunter 6s, led by S/L. R. L. Topp, and a Valiant from No. 90 Sqn. captained by S/L. H. C. W. Spackman will represent the R.A.F. at the Norwegian air display to be held at Rygge, near Oslo, next Sunday, August 25.

Nuclear Safeguard

SPEAKING in Melbourne last week, the British High Commissioner in Australia, Lord Carrington, said that Britain's V-bombers and nuclear weapons were as much a safeguard for Australia as for the U.K. They "had replaced the Royal Navy in protecting Australia," which could count on Britain's willingness to deliver a nuclear deterrent should need arise.

U.S.A.F. Bomarc Contract

A CONTRACT worth $139,315,444 (about £50m) has been placed by the U.S.A.F. with the Boeing Airplane Co. for Bomarc surface-to-air missiles. Forecast as likely to be signed soon after the start of the fiscal year, this contract (the first practical example of the U.S.A.F.'s advance procurement policy) follows a $7,109,195 development and testing award. The price of Bomarcs has been reported as $350,000 each.

"Brab's" New Honour

SUCCEEDING Sir Edward Appleton, Lord Brabazon of Tara has been elected president of the Radio Industry Council, and as his first important duty in that office will open the Radio Show at Earl's Court on August 28.

Firebees for R.C.A.F.

R.C.A.F. headquarters announced recently that the Ryan Firebee target drone —thirty of which are on order, with deliveries due to start next January—would come into R.C.A.F. service in 1958.

Foamed Aluminium

A REPORT from the U.S.A. says that foamed aluminium, weighing only 15 lb/cu ft, has been produced there by a new and still experimental process which has been evolved after ten years' research with U.S.A.F. support. The foam is said to have good rigidity characteristics but to lack compressive strength.

Sabres from Japan?

REPRESENTATIVES of Mitsubishi Heavy Industries, which has been building F-86F Sabres under U.S. licence for the Japanese Defence Board, have been seeking U.S. Government and North American Aviation approval for the export of 25 of these aircraft to the Dominican Republic. The company said Dominica has offered to buy their Sabres for about $10m (about £3.6m) because the type could no longer be supplied by the U.S.

Lofty Confinement

A BALLOON ascent to a maximum altitude of 102,000ft (nearly 20 miles) was to be attempted this month from a site in northern Minnesota by Maj. David Simmons, head of the space biology branch of the astro-medical laboratory at Holloman Air Development Center, New Mexico. Maj. Simmons, a doctor, planned to remain in the small aluminium gondola for 24 hours to test physical and psychological reactions in cramped quarters at high altitude.

Modellers' Farnborough

NEARLY 1,000 entries from about 100 model aircraft clubs are expected for the 24 contest classes in the 1957 All-Britain Model Aircraft Rally at Radlett Aerodrome, Herts, on Sunday, September 22. Among teams competing will be one from the U.S.A.F. The airfield is on the A5 road, or is easily reached by train (from St. Pancras) or bus (Green Line 712 and 713 to Radlett, or local route 355 passing the entrance).

Gloster Chief Retires

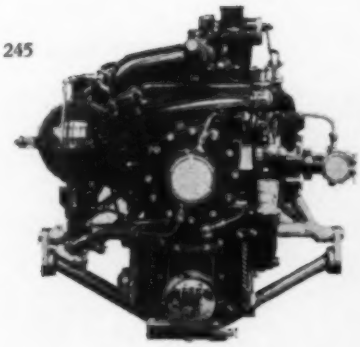
OWING to ill-health, Mr. P. G. Crabbe has had to relinquish the managing directorship of the Gloster Aircraft Co., Ltd., which he has held since 1952. For the time being Mr. Hugh Burroughes, who has been a member of the Board for many years, will be in the managing director's chair as vice-chairman of the company. Mr. Crabbe, who is 61 this year and has been associated with the Hawker Siddeley Group since 1919, joined the Gloster Aircraft Co. in 1946 from Armstrong Whitworth Aircraft, Ltd., where he had been assistant general manager. During his time at Glosters the company has built nearly 4,000 Meteors and is now, of course, producing Javelins in quantity.

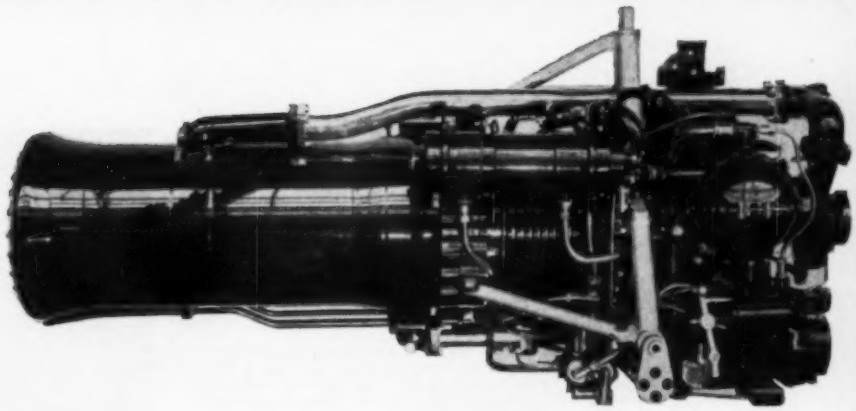
Mr. P. G. Crabbe.

R.A.F.A. Stamp Exhibition

ON Saturday, September 14, the R.A.F. Association Philatelic Society—which now has 400 active members in 25 countries—is holding a Battle of Britain Week Exhibition at the R.A.F.A. headquarters, 83 Portland Place, London, W.1, from 2.15 p.m. onwards. Nearly 500 sheets of philatelic material will be on view.

HIGH-DENSITY SPRAYING is the function of this Auster Agricola, now undergoing tests. Protruding from the lower surface of the wing, the nozzles cover the complete span of the aircraft, and wing-tip vortices give an effective swirl to the spray.





SPECTRE

de Havilland's Latest Rocket Motor

THE first flight of the Saro SR.53 mixed-power research intercepter, on May 16, was a decisive point in the de Havilland Engine Company's rocket-motor development programme. The Spectre's history began almost ten years ago, when studies into future fighter-engine requirements suggested that, as combat heights and speeds increased, the superiority which the rocket confers in climb and acceleration would also become greater.

The original idea of elaborating upon the Messerschmitt Me163 formula was soon abandoned in favour of a mixed powerplant—a concept first mooted for the Me262 with the BMW 003R. In due course, D.H. propaganda in favour of rocket engines for manned aircraft was supplemented by an official requirement for a controllable-thrust unit. Contracts were placed for two (to become the de Havilland Spectre and the Armstrong Siddeley Screamer) offering power comparable with that specified for the second-generation axial turbojets then in the design stage. The specification called for a very low residual idling thrust, with full control all the way to maximum power and the ability to run at full thrust for long periods.

D.H. rocket development started with the simple Sprite "cold" A.T.O. unit for the Comet 1—demonstrated at the 1952 S.B.A.C. Display—and led on to the still simple, but "hot" Super Sprite, now in production as a jettisonable pack for the Vickers Valiant. Lessons learned from these simple liquid rockets have helped in building up the Spectre's design background; but a fully controllable, continuously running rocket engine is an entirely different proposition.

From the date of the development contract, work on the Spectre progressed to an initial "cold" run (i.e., using only high-test hydrogen peroxide catalysed to superheated steam) in July 1953, followed by the first "hot" one in September of that year. In October, the DSpe.1 engine passed an acceptance test and by July 1954 it had reached its design rating. All these test-bed runs were made with a water-cooled reaction chamber and nozzle, but in November the external cooling was discarded and one run of over an hour was made, using simply the integral H.T.P. cooling system. The next stage was the refining of the design, leading to the DSpe.3 and DSpe.5. Also, in 1952 a M.o.S. contract was placed for the development of simplified constant-thrust units—suitable for A.T.O. (and, palpably, missile) applications—which became the DSpe.2 and DSpe.4.

In the latter half of last year the Spectre successfully passed a series of pre-flight special-category type-tests.

For initial flight trials, the second prototype English Electric Canberra (Nene-engined) was passed by the M.o.S. to Folland Aircraft for modification as a flying test-bed. The Spectre was mounted aft of the rear bomb-bay bulkhead, pointing downward to keep the efflux clear of the rear fuselage and tailplane. The crew is able to see the nozzle in a 4-in screen in the cockpit served by Pye closed-circuit TV from a camera in the bomb-bay. The first flight test was a "cold" firing last December, and "hot" firings started in January. Prior to the flying of the SR.53 at Boscombe Down, representative ground tests were made at Hatfield with a Spectre mounted in a complete tail unit.

Choice of Oxydant

Arguments for the use of H.T.P. (83-87 per cent concentration) as oxydant for manned-aircraft rockets are based primarily upon safety in handling; and it offers distinct operational advantages over the other liquid oxydants, liquid oxygen and nitric acid. In the first place, it is stable over the normal range of temperatures, so that there is no question of boiling, requiring pressurized containers and causing frosting, as with liquid oxygen, nor of the rapid loss of strength, as with nitric acid. The ghastly corrosive properties of nitric acid require no recapitulation—it is not known if the chemical inhibitors developed by the French S.E.P.R. concern protect flesh as well as metal. On its own, H.T.P. is a fuel and can thus provide starting and auxiliary drive power—for turbojet as well as rocket—and the heat of decomposition, 600 deg C, is sufficient to ignite the main propellants. Moreover, the "exhaust" need not be dumped, but can be fed into the reaction chamber, where the oxygen takes part in the main combustion. Since H.T.P. is combustible with normal turbojet fuel, it means that the aeroplane is more flexible than where a special rocket fuel has to be carried, while the supply problem is greatly simplified.

Functionally, the use of H.T.P. makes possible automatic purging of the reaction chamber by steam, both at firing and at shut-down. Two cogent factors occur in the actual combustion. At the stoichiometric mixture ratio (i.e., chemically correct, or 9 to 1 by weight) the temperatures are of the order of 2,000 deg C, or well within the capacity of existing materials for lengthy running periods. The second point is that, should the mixture ratio be off the optimum, the temperature will fall, causing relatively innocuous "cold" spots.

At this stage it is officially permissible to comment only upon the externally obvious features of the Spectre. First, and the most obvious, feature is that it is a self-contained unit only 56.5in long, of 26.5in diameter, and 32in over its mounting, yet with the thrust of a later Avon and perhaps an eighth of the weight. The installational advantages to the aeroplane designer of such a neat package of high thrust, requiring neither intake duct nor jet-pipe, are clear; against this, of course, must be set the bulk of oxydant tanks as well as the weight of their contents.

Fundamentally, the Spectre is a three-piece cylinder—of about 13in diameter and 44in length—the forward part of which has annular ribs. This would appear to be the actual reaction chamber, which has to be of high-pressure type (i.e., of the order of 500 lb/sq in) to obtain efficiency over the throttling range.* Exactly half the overall length of the engine is the cooling jacket of the expansion nozzle, which appears to have a lip diameter of about ten inches.

Mounted on the forward end of the reaction chamber is a casing, which is a gearbox. At the bottom of this casing is a large oil sump, identifiable by filler and sight glass on the port side. A pipe connects the bottom of the sump with a horizontal cylindrical casing on the starboard side. This casing, which is reminiscent of an oil filter, is connected by a pipe at its other end to a union on the gearbox casing. The forward cap of the cylinder is a large-bore Y-junction, one branch coming from the fuel pump outlet and the other going to an obvious control valve on the port side of the combustion-chamber casing—from which it is clear that the cylinder is a fuel-cooled oil cooler.

Delivery Systems

The fuel pump (port side of gearbox) is identifiable by its circular casing, as well as its axial inlet and tangential outlet connections for one-inch tubing. The pump is obviously centrifugal.

On the forward face of the gearbox casing is an even more obvious centrifugal pump with an intake some two inches in diameter on the engine centre-line. This pump delivers tangentially through a narrow throat into a one-and-three-quarter-inch tube. The throat, which is a diffuser for converting fluid velocity into pressure, confirms this as a high r.p.m. centrifugal vane-type pump. The delivery continues along the top of the engine to an elbow half-way down the expansion-nozzle casing—indicating that de Havilland have taken advantage of the 9 to 1 mixture ratio to use H.T.P. as coolant.

The forward end of the expansion nozzle has an outlet elbow underneath, which is connected to another elbow at the front of the reaction chamber. The inference is that the H.T.P. is delivered on to the catalyst (probably silver-plated gauze) at the head of the reaction chamber, from which the products of decomposition enter the chamber as hot gases.

Numerous control valves mounted round the body, with linkages and bell-cranks on the starboard side show how the fuel and oxydant deliveries are controlled and sequenced so that the fuel comes in last and is cut off first. The location of the fuel union aft of the ribbed section of the chamber casing suggests that the fuel's internal passage provides pre-heating to aid atomization before it is injected into the oxygen-filled chamber.

Since there is no sign of a large outlet. or dump, it is apparent that the steam turbine used to drive the propellant pumps logically exhausts into the reaction chamber.

A tapping from the intake side of the oxydant pump is connected by a small-bore pipe to a plunger unit with a lever actuating linkage, low on the starboard side. Mounted on top of this unit is a spherical casting which could only be a flexible-diaphragm accumulator. A pipe leads from the plunger unit to a T-junction on top of the sphere, from which a larger pipe leads to a connection on top of the gearbox/reaction chamber junction. The whole assembly suggests a pressurizing system for manually starting the turbine pump, since it would seem illogical to introduce electrics to an engine which has both initiating energy and ignition properties in its oxydant—also, no electrical leads are apparent.

The triangulated tubular mounting takes the thrust from lugs on the front and rear flanges of the reaction-chamber casing and transfers it to two low-set lateral trunnions and a steady-spigot above the engine centre-line.

The de Havilland Engine Company points out that all major components, valves and control units are of its own design and manufacture.

J. H. S.

* *Those wishing to make their own deductions from the "externally obvious features" of the Spectre are referred to Mr. S. Allen's R.Ae.S. lecture "Rocket Motors," (summarized in "Flight" of October 19, 1956) wherein Screamer development was described: and also to a description and cut-away drawing of the Screamer in "Flight" for July 27, 1956.*

АЭРОФЛОТ

More About Aeroflot and its Methods

By CLIVE JENKINS PART 3

THIS third instalment concludes the account—exclusive to "Flight"—of a tour of Russia's great Aeroflot organization made by a British delegation from the Airways Section of the Association of Supervisory Staffs, Executives and Technicians (of which the author is an official).

LACK of time during our visit to Kiev had precluded a study of air traffic control procedures, but the deficiency was remedied two days later at Kharkov. The original airport had been wiped out in the battles which raged there during the war, but the hangars were rebuilt in three stages during 1952-54, and the new terminal building was completed in 1954.

Squadron Manager Kosenko showed us over the control tower. It was made clear that the aircraft are controlled entirely from the ground. One on its way to Kharkov, for example, which had to be diverted by reason of Kharkov weather conditions would receive instructions from the traffic control centre there. It would then proceed to one of the seven diversionary airports around that city. The control tower was manned by only one controller on each shift for the 200 daily movements (he was relieved for meals). Kosenko explained that the movements were mainly transit and so distributed as to take place at six- to ten-minute intervals during the day, with rather wider spacing at night. There was no substantial "peaking." Kharkov has 40 Il-12s and Il-14s based there and plans are in hand to duplicate the Kiev heavy-maintenance base. Including aircrew, this will considerably increase the present staff of 1,200.

The strain on ground services varies enormously throughout the European part of the U.S.S.R. Some airports have to provide permanent medical air services to transport doctors and nurses to inaccessible villages. Others maintain helicopter groups for rescue work as well as for agriculture. A typical job for the Mi-4 helicopters this year was the dropping of 27 tons of dynamite on the massed ice of the Angara River which was threatening the new hydro-electric construction project at Batsk. Other airports operate daily fire-brigade flights over wooded areas (e.g., the Altai mountains) with five trained fire-fighters aboard each aircraft in order to catch forest fires early.

But this kind of work pales beside the size of the agricultural tasks which are carried out in every season. At Krasnodar, capital of the Kuban region, An-2s land and take off every few minutes to seed and spray—and the airport official-in-charge can report in detail of the state of the crops ("this year they are bumper" he told us). As well as this he has to look after 30,000 local passengers annually, plus transit flights (120 movements each day). He has a staff of at least 250 to assist him, but all this work has to be done at a grass field which has a distinct tendency to become waterlogged in the rainy season.

Sochi-Adler has a different problem. This serves the great Black Sea holiday and sanatoria districts of Sochi and Matesta (where the sulphur baths have been developed) and other towns in a 250-km catchment area along the coast from Tuapse to Gagray. It has only one concrete runway, which handles 100 movements a day over the seven months of the year when the climate is at its best. Many of these movements are all-freight, bringing food into the area. On peak days 250-300 passengers arrive and depart. Unfortunately Adler is 22 miles from Sochi, but a rail link exists. Services are mainly from such industrial areas as Moscow, Leningrad, Stalino and Novosibirsk, with the longest flying time journey being one of 32 hours—from Khabarovsk. The staff numbers only 120 (all on the ground: no aircrew are based on Adler). The average passenger load is 25 in an aircraft which seats 32 passengers.

This captain's two lapel badges indicate that he has flown two million km; in this scene at Moscow he is being fêted on completion of his third million km, qualifying him for another badge.

One of the busiest routes is to Leningrad, which takes 8 hr 50 min, with stops at Krasnodar, Stalino, Kiev, and Minsk.

Leningrad itself has a staff of 800 (including 60 aircrews of three or four each) with 140-160 movements each day involving 400-500 passengers, with a mean of 250 in the winter. The 30 Ils based on it are sent for major repairs to Moscow, Minsk or Kiev. The line-maintenance staff numbers 200, working (like the rest of Aeroflot) a 46-hour week. Work is done in two 12-hour shifts by airframe teams and three eight-hour shifts by the engine men.

Leningrad has connections to all the main cities of the U.S.S.R. but particularly to the fast-developing areas of Siberia and Vladivostock. Other busy routes are those to Tallin, Riga, Sochi-Adler, Simferopol, Kharkov, Tashkent, Kuibyshev, Sverdlovsk, Murmansk and Archangel. Leningrad is also one of the few international airports; regular connections are made with Stockholm and Helsinki and facilities are good in its 1949-built terminal.

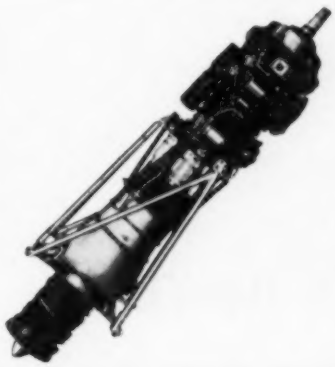
But Leningrad's weather is often bad, and fog troubles the airport in the winter months. It is cleared for brief periods by spraying the clouds with powdered dry-ice through a special nozzle fitted to an An-2 biplane. This usually causes precipitation in the case of "warm" fogs, improving visibility enough for the pilot to land. Alma Ata (in a valley high above sea level) can be kept open only by a regular daily spraying during some months of the year. Another snag about the airport is that it is 12 miles from the city, though this is now being overcome with special bus services. The Metro is also being extended in the direction of the airport through districts where considerable house construction is proceeding.

The deputy squadron manager, Mikhail Mikhailovitch Lobankov, said they were building new hangars and pointed to ruined buildings along the perimeter: "The Germans came that far during the siege—and we are still rebuilding."

An-2 Kolkhoznikov biplanes were also in use in the Leningrad area. As well as justifying their "Collective Farmer" title they are used for every job demanding a short runway, take-offs in bad weather or a low stalling speed. Their heavy-maintenance section is centred at Rostov-on-Don.

The engineering superintendent here, Mark Averbakh, was

Members of the British delegation leave Kharkov for Rostov: Left, Mr. J. McGuire, works manager of B.E.A.'s engineering base, says goodbye to the Kharkov fleet manager; wearing spectacles is the chief of Aeroflot's Ukrainian territorial board. Right, on the steps of the Il-12, are Mr. McGuire, Mr. D. McKernan (B.E.A. inspector, L.A.P.), Mr. A. Harris (B.E.A. duty officer, L.A.P. Central), stewardess Svetlana Kalinin and Mr. H. Mooney (B.O.A.C. Argonaut fleet supervisor, L.A.P.).

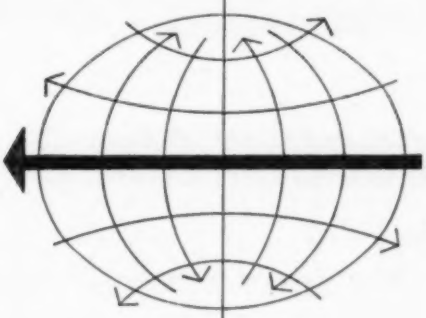


ELAND (for fixed wing aircraft) propeller-turbine engine for new airliners and conversion of piston engine airliners to propeller-turbine power. Chosen for the Hamburger Flugzeugbau C209 and the Convair 340.

ELAND (for helicopters) specially designed for the Fairey Rotodyne, is basically the standard Eland with an auxiliary compressor mounted at the rear. A further design with a rear gear box is installed in the Westland Westminster helicopter.

ORYX turbo gas generator designed for helicopters where the rotor is propelled by jet reaction at the blade tips.

NAPIER AERO ENGINES



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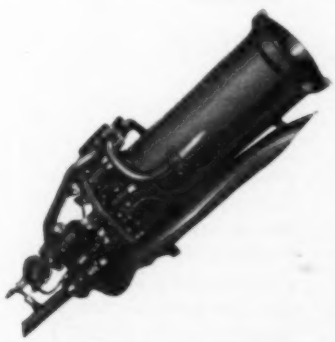

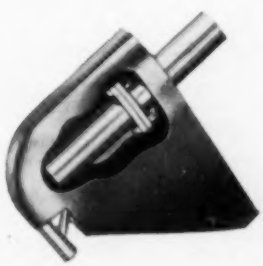

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BRITISH EUROPEAN AIRWAYS

(Left) Workers in the Ilyushin maintenance hangar at Kharkov listening to a talk by the author. (Right) Employees who have broken output records, devised new methods, or otherwise earned approbation have their portraits displayed at the various maintenance bases.

AEROFLOT . . .

formerly in a senior position at the central Scientific Research Institute in Moscow, and this seemed to be reflected in the pattern of organization: Rostov was the only base where planned workshop loading and progressing could be observed. This control was performed by a staff of two, who had broken the operations down into 92 parts. A C. of A. is done on a line system in nine stages. The aircraft remains at each stage for a day-and-a-half, and there is a 15-day turnround which includes the test flying.

Rostov base handles 16 major overhauls each month from the agricultural territories, principally of the Ukraine, North Caucasia, Georgia and Azerbaijan. The base engineering strength (excluding line maintenance, which works three shifts around the clock) is 200. These work a day-shift except in the upholstery section, which needs a double day-shift to cope with the fabric repairs. Everyone is on piecework, and this enables them to earn up to 60 per cent of the basic pay. But if a shop gets a "placing" in the Socialist Emulation List following the monthly meeting between the superintendent and the union-committee a special sum of money is made available to its shop fund for sharing. These "places" are awarded for success in meeting targets.

Other awards are made in the same way if costs are notably reduced. Cost and production targets are first set (within the base plan) at general shop meetings, and the resulting agreement is signed by the shop supervisor and the trade union representative; then it has to be countersigned by the superintendent and the chairman of the base union committee. Any disagreement between the management and union officers which cannot be settled at local level goes to the territorial union committee for arbitration. This parallels the national procedure, where a stubborn "difference" between Aeroflot and the Union would go to the All-Union Council of Trades Unions for final arbitration. The dispute on flight-time limitation went there three times before a decision was finally given.

Averbakh said he did not know the precise strength of the An-2 fleet he serviced. This was apparently not his concern, but that of the territories. All he was interested in was to receive the machines for maintenance after they had flown 1,000 hours (it was 800 until a few months ago; then the scientific-research team at the Central Institute—who were carefully over-flying selected aircraft and then stripping them down—decided to lengthen the period between overhauls). Engine life is 600 hours: after an engine change there is a standard 30-minute test flight. Oil is changed after 50 hr.

Rostov Airport has a town terminal which does not process passengers but merely sells tickets; it does, however, supply a special bus service at twenty-minute intervals from the door to the eight-miles-distant airport (members of the public can use it freely, too, on the same fare-paying basis). At this terminal we were informed that Aeroflot, when calculating load sheets, allows 85 kg for each adult passenger including 10 kg free baggage allowance on all internal routes (B.E.A. estimate 75 kg plus 15 kg free baggage). Aeroflot also calculates 40 kg for each child, but with no baggage (B.E.A. allows 39 kg, but baggage is permitted, too). But while B.E.A. estimates 8 kg for each infant-in-arms, Aeroflot simply does not bother.

In general, the Rostov base (built in 1955) was clean and well equipped. The radio and instrument shops were soundly laid out and the organization was more detailed and "planning-minded" than others we had seen.

This view persisted even after the Tu-104 line-maintenance organization was visited a week later. It is situated at Vnukovo in hangars of modern design, which are, however, too small and low to accommodate the long, high Tu-104s. Until recently the "fleets" of Tu-104s supplied their own aircrews and technicians, but this has now been changed in favour of a centralized administration. Line maintenance is now completely separated from the fleet management of the Tu-104 groups. The crews fly their aircraft in and hand over to the base at Vnukovo which, I understand, is the only one carrying out 100-hour checks.

Said the superintendent, Simeon Simeonovitch Sokolovsky, "We provide a full technical service broken down into three sections—pre-flight and after-flight checks, 50-hour checks and 100-hour checks, together with engine changes as needed."

For the maintenance of a fleet which we estimated to be in excess of 50 Tu-104s (12 were being worked upon while we were there, and there were a few in other parts of the field) Aeroflot has trained 300 technicians. After completion of a correspondence course and attendance at a higher-educational institution they qualify by examination for a turbojet technicians' certificate. Some—shop superintendent Smirnov is one—have graduated from Kiev itself in this way. Six obtained civil aviation engineering diplomas in 1955, and nine in 1956. Sokolovsky would not disclose staff categories on Tu-104 maintenance, but said it had been necessary to train them while they were still on piston-engined aircraft servicing. This had been done without any increase in staff numbers.

Hangars are now being planned to take the Tu-104s, as open-air maintenance is, obviously, difficult in Russia's winter. "Bases are also to be set up for major overhauls . . . we haven't done this so far." Work is organized on a 24-hour three-shift basis, with one supervisor (occasionally two) in charge, together with a technical controller.

As the Tu-104 has been in service for less than 12 months it was admitted that the annual utilization has been low and that many difficulties were anticipated which had not yet developed: in particular, pressurization was mentioned. The aircraft has two separate pressurization systems, one being for the flight deck alone. There are also oxygen hand-sets for each passenger in case of decompression for any reason.

The period between overhauls of the RD-3 engine is only 300 hours, but this is expected to be revised soon. It was claimed that there had been no engine failure as such, although components had sometimes required replacement. When an engine has to be changed for such a reason it is replaced with a part-life engine in order that the 300-hour engine changes may be "done double." Sokolovsky has a team which specializes in engine changing. The members of the team also specialize individually and have reduced the time taken from five days to two (96 man-hours).

There are usually four aircraft on maintenance at once, two inside the hangars and two outside. Each shop shift has a leader who both supervises and has a responsibility to teach and raise the technical standards of his men. If a shift is large it is divided into teams. But at the commencement of work it is always called together to hear the shift leader detail the general programme, analyse the work of the preceding shift and convey any message or criticism from the shop superintendent.

The 100-hour check is done in eight hours by eight specialist teams of four to six men each. There is one team for each engine and one each for undercarriage, pressurization, upholstery, radio, instruments and electrics. They are occasionally held up for component supplies as "some lives are still a little uncertain."

The engineers (some of whom went to the RD-3 factory for engine experience) sign out their own work, but it has to be countersigned by the supervisors to whom they are responsible. The complete aircraft is signed out by the shift leader or, to give him his full title, the shift controlling supervisor. He is not finally responsible to the shop superintendent, but can go direct to the engineering superintendent.

Each shop, too, has a "senior technical inspector" while each shift has one or two or three of these depending upon its size.

(Concluded at foot of page 249)

CIVIL AVIATION

VISCOUNTS FOR INDIA

THE first of Indian Airlines Corporation's fleet of ten Viscounts was last week formally handed over to the High Commissioner for India, Mrs. Pandit, by the chairman of Vickers, Lord Knollys. The ceremony, which was performed at Wisley Airfield, marked the tenth anniversary of India's independence.

Delivery of I.A.C.'s Viscount 768s (Dart RDa.6 Mk 510s) will start in September, when the first aircraft (VT-D10) will be ferried out to New Delhi; the order should be complete by April next year. The airline hope to start Viscount services between Delhi and Calcutta, Calcutta and Rangoon, Bombay and Delhi, and Bombay and Karachi in mid-October. Expansion of the services to include Hyderabad, Bangalore, Madras and Colombo will be made during 1958.

. . . AND FOR COLONIAL COACH

AFTER five years of developing their Safari services with Vikings, Hunting-Clan and Airwork are to take advantage of the recommendations of the Air Transport Advisory Council (see *Flight*, July 5, 1957) to introduce Viscounts on their Central African Safari Service—probably in early October. The East African Viscount Safari service should be introduced shortly afterwards.

Rival claimants to be the first operators of Viscounts on colonial-coach services are Central African Airways, who are to use Viscounts on their weekly Zambesi service to London.

NEW STARS IN THE POLAR FIRMAMENT

THE polar routes are becoming busier. Civil Aeronautics Board approval for PanAm and T.W.A. to start over-the-top flights between Europe and California has resulted in almost simultaneous announcements from the rival U.S. flag carriers of new services from London and Paris to Los Angeles and San Francisco. B.O.A.C., whose right to offer competitive services on the trans-polar route to San Francisco is of course agreed in principle, are, meanwhile, still bedevilled with equipment problems. Their DC-7Cs—the only aircraft in the fleet with sufficient range—are heavily engaged in restoring the Corporation's share of North Atlantic traffic; and not until the Britannia 312s come along could the Corporation contemplate wresting trans-polar traffic from the U.S. airlines. Even then, such is the need for the 312s on the Atlantic, that the advent of B.O.A.C. polar flights may have to be delayed until 1960 when their 707s are delivered.

The larger share of the polar Europe to West Coast route—four DC-7C services a week—goes to PanAm, who will inaugurate one-stop schedules on September 11. They will operate from London to Los Angeles and then on to San Francisco, London to Seattle and San Francisco, and Paris to Los Angeles and San Francisco. A fuelling stop in each direction will be made at Frobisher Bay, Baffin Land, although there is a possibility of non-stop operations on the eastbound run. A direct service to Portland, Oregon, will be started later in the year.

T.W.A. will begin operation of two weekly mixed-class L.1649A Jetstream services—one from London to San Francisco and Los Angeles and one from Rome to Paris, San Francisco and Los Angeles—on September 30. They also will refuel at Frobisher Bay, although various other alternatives may be used. In any case, the chances of achieving non-stop operation are sufficiently good to warrant the Jetstreams carrying two complete crews on east-bound flights; if the weather is reasonably good and the payload does not exceed 60 or 70 per cent, a stop at Frobisher Bay to refuel and to slip a crew would not be necessary.

Even one-stop polar services between London and the West Coast reduce the present point-to-point times by about three hours. PanAm's service to Los Angeles will take 21 hr and T.W.A.'s service to San Francisco 21 hr 5 min, and to Los Angeles (including the San Francisco stop) an elapsed time of 23 hr 42 min. The return trip will be timetabled to take 19 hr 10 min, but this would be reduced when the flight was made non-stop.

B.E.A. CURTAIN-RAISER

NEARLY ten years after the interruption of direct flights from London to Prague, services will (as already foreshadowed) be resumed on October 6. Final arrangements were being made in Prague last week by a B.E.A. team of 15 officials led by Mr. A. S. Johnson. The Corporation will operate Viscounts on the 650-mile route between the two capitals and Czechoslovak Air Lines will operate a similar service with Il-14s, although there is a strong possibility that Tu-104As will later be used. The latter aircraft are to operate on C.A.L.'s new routes to Cairo, and Damascus *via* Beirut, in November, the only direct connection between Czechoslovakia and the near East is at present provided by Air-India, who fly a weekly service between Prague and Cairo.

HONG KONG AND NORTHWEST

ONE of the traffic rights sought by the U.S. during the abortive route talks held in London recently was the right for Northwest Airlines to operate into Hong Kong. Until August 1—when the arrangement was cancelled—Northwest did, in fact, operate into Hong Kong through a charter arrangement with Hong Kong Airways, by which H.K.A. aircraft were used on the Tapei-Hong Kong and Manila-Hong Kong segments of Northwest's routes from Tokio. Cancellation of the seven-year-old charter agreement was made by Hong Kong Airways immediately before the inauguration of a Viscount service between Tokio and Hong Kong *via* Tapei. Northwest are now reported to be seeking a new charter agreement with Cathay Pacific Airways, the British independent airline based in Hong Kong.

GHANA AND K.L.M.

A PLAN for a jointly operated airline company for Ghana has been proposed by K.L.M. The Ghana Minister of Communications, Mr. Krobo Edusei, said earlier this month that the Dutch airline had proposed that they should form with the Ghana Government a joint company to operate direct services between Ghana and the United Kingdom and other European countries. K.L.M.'s interest would extend to the expansion of Ghana's aviation and the training of ground and air crews of Ghana nationality.

Hunting-Clan have also placed air-service proposals before the Ghana Government, but no details have yet been revealed. Ghana's reactions have not so far been obtained.

THE AIR LEAGUE AND AIR TRANSPORT (continued from page 243)

the C.A.B., "but without the complicated legal procedures of the latter body." A new Board should be composed of four or five persons highly qualified in air transport but unconnected with the Corporations or the independents. It would be non-political and unaffected by changes of government. This Board should be charged with the issue of licences for the operation of particular routes by particular operators in a manner apparently similar to that of the C.A.B.. "The establishment of such a Board would be a major reform which, coupled with the principle of partnership between the Corporations and the independent operators, should lay the foundations for the necessary expansion of British air transport in the coming years."

The report also has this to say about the supreme direction of British air transport: "Some single authority of senior Cabinet Minister status should be charged as his prime task with the co-ordinated development of British civil aviation, and whether that single authority be the Minister of Transport and Civil Aviation or some other minister we urge strongly that any other functions ascribed to him should be secondary to the task to which we refer. Such an authority would be responsible for seeing that all the essential elements combine to produce the maximum of drive and efficiency, with the sole and concentrated object of placing this country in the position in world air transport which it ought to have, so reversing the downward trend of the past few years."

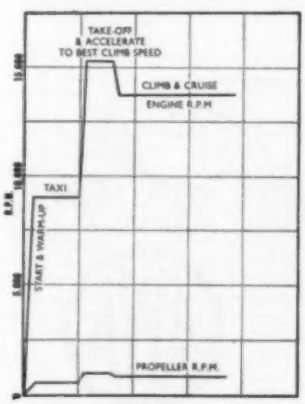
The report sees no reason to doubt the accuracy of Lord Douglas' estimate (in his Brancker Memorial Lecture) that between now and 1970 there remains an unfulfilled market worth £5,500 million. "This affords some idea of the prize which awaits the country which can produce, and produce quickly, transport aircraft of advanced design and proved reliability." The committee recommends strongly the establishment of a Government-sponsored Proving Unit to carry out development flying on "selected" transports. An organization similar to that at Boscombe Down is visualized, with representatives of manufacturers and R.A.F., as well as civil crews, participating to offer the customer fully developed and tested aircraft of guaranteed performance and costs. "Development work on new types should not be left entirely to manufacturers, the operators, or the R.A.F., but should be a joint effort."

As examples of the sort of aircraft which could be developed for the future, the committee cite a large cargo transport and a supersonic airliner. It foresees the need for a very large, 500 m.p.h. cargo machine with a 3,000-4,000 mile range, to operate at half the current cargo rates. A bolder venture might, says the report, be the long-term development of a nuclear-powered cargo carrier.

With regard to the supersonic airliner, the committee feels that this is an opportunity to make a great advance in world aviation by "reaching out into the future . . . instead of producing something only a little better than the coming generation of American airliners." (See photograph of model on page 243.)

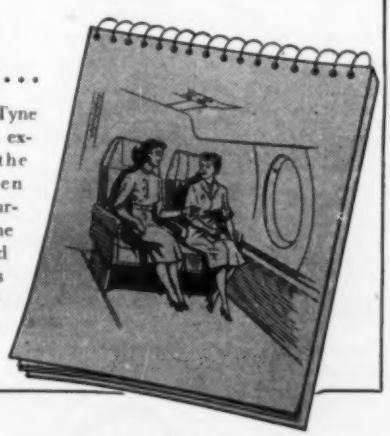
Yes, with the VANGUARD

The many problems of noise nuisance on and around airfields will be reduced by the introduction of the Vickers Vanguard. Noise from the four Rolls-Royce Tyne propeller-turbines is remarkably low for an aircraft of the Vanguard's size and power. This will be of particular advantage when operating from airfields in or near residential areas. A lower noise level on the airport will also increase efficiency in the administrative blocks and improve the broadcasting of passenger information. The lower interior noise and vibration will win approval from operators, pilots and passengers.



For your notebook...

Gases from the Tyne engines are only exhausted after the power has been absorbed by the turbine. This is one reason for reduced noise. The other is the low propeller tip speed.



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CIVIL AVIATION . . .

BREVITIES

SIR DAVID CAIRNS, Q.C., has been appointed to hold the public inquiry into the B.E.A. Viscount accident at Manchester airport on March 14. Captain R. N. White, Prof. S. C. Redshaw, and Prof. A. Thom have been appointed as assessors. The inquiry will open on November 11 at Holborn Town Hall.

* * *

East African Airways are to start new Canadair Services to Aden, Karachi and Bombay on September 15.

* * *

Lt-Col. J. E. Everington has been appointed to the board of Central African Airways.

* * *

PanAm will start thrice-weekly non-stop flights from New York to Rome and daily non-stop flights to Frankfurt on October 27.

* * *

It is reported from Athens that Greece has agreed to allow Aeroflot transit rights through Athens airport provided reciprocal rights are granted.

* * *

The British firm of Air Finance, Ltd., are reported to have extended a loan of £3,135,000 to El Al to help finance their purchase of three Britannia 313s.

* * *

T.E.A.L.'s equipment problems apparently remain unsolved. On August 14, the chairman, Sir Leonard Isitt, left Sydney "to look for new aircraft for the trans-Tasman service." He said he was also wanting suitable aircraft to replace the airline's 27 DC-3s.

Bendix (Eclipse Pioneer Division) PB-20 automatic flight control systems are to be supplied to Convair for the 880. They are also being supplied for the Electra, 707 and L.1649A.

* * *

A Soviet Il-14 crashed into the harbour at Copenhagen on August 15 while approaching to land at Kastrup airport in a slight fog. It is reported to have struck a chimney. There were no survivors among the 23 people on board.

* * *

As a result of the French monetary changes, all fares paid in francs have been increased by one-fifth. I.A.T.A. carriers put new rates into effect for flights out of France on August 14, and Air France accounts with other international airlines are now based on an exchange rate of 1,176 francs to the pound.

* * *

A new B.O.A.C. appointment is that of engine development manager at their Treforest repair factories. Mr. E. R. Chaytor will fill the post from the beginning of September. Other recent appointments are of Mr. D. F. Johnson to the new post of inter-line sales superintendent in London and Mr. J. H. Bingham as manager, San Francisco.

* * *

The report of the Committee of Public Accounts says that site values at London Airport have increased to an extent where B.E.A. and other tenants are paying less than half the current open-market ground rent for their maintenance bases. They recommend lease terms providing for revision of ground rents every ten years.

AEROFLOT (continued from page 247)

On average, there is one inspector for every ten operatives. They do not tolerate an "allowable deficiency level." If there are any defects the aircraft does not fly and one of the numerous stand-bys is put into service.

Well-equipped radio and instrument shops on the first floor at the back of the hangars handle all the necessary work. Radio equipment is checked after 400 hours.

Alongside these shops we saw classrooms intended to familiarize technicians with Tu-104 components. From questions and observations during the tour it was gathered that thermal de-icing was being employed. Other snippets of information were that flexible tanks have been adopted, that there had been no brake trouble in 800 hours and that tyres were changed "as required" instead of after a regulation number of landings.

Later, Alexei Mikhailovitch Leontyev, general secretary of the union, gave me data on pilots' conditions of work on the Tu-104. Annual maximum flying hours are 500 (with a limit of 50 in any one month) and bring two months' holiday. Hours on the ground are restricted to one-and-a-half before departure and one after arrival. The crews are paid a basic salary plus a mileage allowance which varies for different parts of the country and the aircraft. There are other allowances for night flying, complex route-patterns and climatic difficulties (e.g., in Siberia, where in certain circumstances triple pay can be earned, plus three months' holiday).

On top of this is a rank differential and seniority pay (applicable to everyone in Aeroflot) which gives from 10 per cent of the basic for three years' service to 30 per cent for 15 years. In addition, an aircrew can earn up to 37½ per cent of their basic as a bonus for punctuality in departures and ability in their duties. An efficient northern area pilot can earn 7,000 roubles a month, which is about twice as much as the manager in charge of his flight and compares with the 1,800 roubles earned by a technician with similar service in European Russia, or the 1,000 roubles earned by a fitter of the same seniority. (A squadron manager can earn 3,000 roubles per month, and a fleet manager may get up to 6,000.)

Average retirement age for a pilot is 37 years. The pilots' pension scheme (based on flying hours) averages 1,500 roubles monthly, and another job is always available on the airline. [Official rate of exchange is 11 roubles to the £ and the tourist rate is 27; a more realistic equivalent is about 40.]

The working week (while on the ground) is the same as for all staff, i.e., 46 hours over six days; but this is to be reduced next year to five days of seven hours and one day of five hours. Night work attracts one extra hour's pay for each shift (for ground staffs) while double time is paid for bank holidays; overtime is rare and has to be specially sanctioned at territorial union committee level. If it *is* agreed, the first two hours are at time-and-one-half and all subsequent hours at double time.

Before our delegation left Moscow to return to London *via* Prague in the Tu-104 (flying time on this leg was 2 hr 45 min) it was received by Lt-Gen. Zaharov (a deputy head and member of the Central Board) in Aeroflot's head office. Discussing the negotiations which had taken place with the British Government delegation—"which was twice as big as yours"—some eighteen months previously, he revealed that the U.S.S.R., which had "readily entered the talks at the British invitation," had proposed a connecting service at an airport in Germany. He commented that he had proposed an airport in East Germany, Templehof, or any British R.A.F. field in West Germany.

But, "although the question was as clear as the stars in the sky," the British Government could not make up its mind; they had promised an answer "in five or six days"; Aeroflot still waited.

Now their views had changed. Aeroflot was prepared to open up *direct* services as long as a diversionary field was made available between Leningrad and London, i.e., in Germany, where a number were suitable.

Zaharov dismissed the suggestion that the West German Government could raise any objection; he quoted from the treaty made by the three Allied Powers with the Federal Government which reserved to them all their old rights in respect of U.S.S.R. aircraft using West German airspace. "So who is holding matters up?" he asked. "B.E.A. wants to come to Moscow. So does Air France." [In the Commons on July 31 the Minister of Transport and Civil Aviation, in a written reply to a question, said that the Russians had been invited to London, but that "the visit has not yet taken place."—Ed.]

His point became clear. Aeroflot apparently believes that the American Government has persuaded the British Government to leave the negotiations in suspense for the time being for reasons of a purely political character. At least one highly placed Aeroflot manager also had the suspicion that when an American operator was suitably equipped with competitive turbojet aircraft the situation might be transformed.

In the meantime an essential British route is denied to the British airways corporations. And it seemed to me that it would be in the commercial interests of the U.K. to adopt an independent attitude and seek to re-open the negotiations by inviting Aeroflot representatives to London (Zaharov told me he would be glad to come as long as everyone was in earnest—and he could negotiate with representatives armed with power to settle the main questions).

In past years the air routes on world maps have all stopped short of the Soviet sixth of the world's land-mass; expansion, it seemed, could be planned without taking Aeroflot into consideration. Our visit has shown that this policy will be unsound in future. With the world's largest turbojet fleet—although it faces massive problems—a newcomer is joining the front rank of the world's airlines determined to establish itself in a strong competitive position within the next four years.

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D.I.A.N.

A Revolutionary New Navigation System: Doppler Integrated with Decca and Dectra

BY the integration of Doppler radar with the Decca and Dectra systems, the Decca Navigator Co., Ltd., have evolved a comprehensive navigation system for operation in any part of the world. Announced after three years of research and development on the part of Decca Radar, Ltd., the new system is known as D.I.A.N. (Decca Integrated Air Navigation system). With its aid, an aircraft can fly from the highest-accuracy Decca Navigator coverage to position itself on one of the many discrete tracks laid by Dectra across (for example) the North Atlantic, returning to Decca near the end of its journey for approach procedures.

The outstanding advantages of this integration are immediately apparent in economy of cockpit space, the Flight Log pictorial display being common to all three navigational aids (and presenting them in what is now widely accepted as an ideal form).

Doppler by itself cannot meet the requirements of traffic control in high-density areas. This is because the heading information, an essential requirement of Doppler operation, is derived from the aircraft compass, the accuracy of which is of a comparatively low order. Moreover, errors are cumulative, as Doppler is a velocity-measuring device and positional errors will increase proportionately with distance flown. For these reasons, state Decca, Doppler alone would not provide a means on which A.T.C. procedures involving close lateral-track separation could be based; and, in addition, it is doubtful whether a system which does not possess a common reference could ever be, in itself, the answer to A.T.C. requirements.

It is for these reasons that the integration of Doppler with Decca/Dectra promises to be particularly effective in areas where precise navigational facilities are required for A.T.C. purposes. Decca/Dectra fulfils that function, with Doppler providing the supplementary facility, while in other areas Doppler provides facilities for normal navigation.

In addition to the foregoing points, advantages claimed for Decca Doppler include the following: wind speed and direction can be displayed if true-airspeed information is available in the aircraft; Doppler accuracy is maintained over both land and sea; by use of automatic wind-memory the accuracy of the Doppler element is independent of aircraft attitude; the Doppler aerial is light and compact, demanding minimum structural alteration of the aircraft; simple setting-up procedure keeps operational complexity to a minimum; outside Decca/Dectra coverage the system is capable of operation at speeds between 100 and 1,000 kt and at heights up to 50,000ft; and within Decca/Dectra coverage the system is unaffected by height or speed.

Turning now to the equipment itself, the Doppler element of D.I.A.N. can be said to consist of three major assemblies: an aerial-transmitter-receiver unit, a frequency-tracker-computer unit and an indicator system. The use of the combined aerial-transmitter-receiver has been decided upon to facilitate installation, and the size of cut-out required in the aircraft skin has been minimized by the use of an aerial which does not swing in azimuth.

The aerial provides four beams, which are used in pairs. The forward port and after starboard beams are employed for one-half of the cycle and the other pair during the remaining half. This Janus configuration is used to reduce errors caused by pitch change.

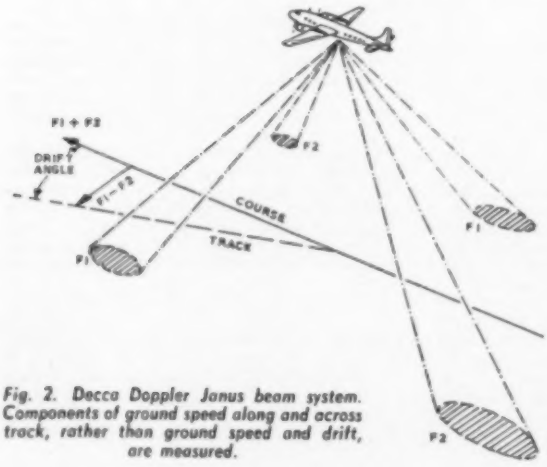

Fig. 2. Decca Doppler Janus beam system. Components of ground speed along and across track, rather than ground speed and drift, are measured.

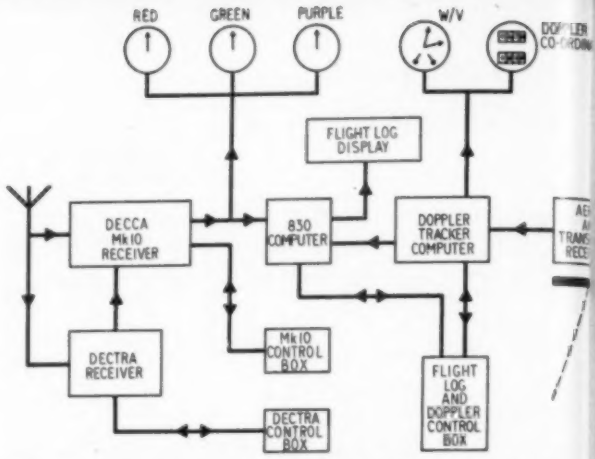

Fig. 1. Schematic arrangement of D.I.A.N. units in an aircraft.

If drift is present, the Doppler frequencies received from the two pairs of aerial beams will not be identical. Unlike other systems, the aerial is not rotated in azimuth to make the two frequencies identical. Instead, the two frequencies (which, referring to Fig. 2 we may call F1 and F2) are measured independently by phonic-wheel discriminators. This measuring technique provides shaft rotations accurately proportional to F1 and F2. It can be shown that F1 + F2 is proportional to the component of ground speed along the aircraft heading and that F1 − F2 is proportional to the component of ground speed across heading. Thus the basic quantities provided by the Doppler system are the two components of ground speed related to the heading of the aircraft.

This is a departure from other systems, in which the basic quantities produced are ground speed and drift; but Decca claim that where the ultimate outputs are required in the form of rectangular co-ordinates such as grid co-ordinates, latitude and longitude, or co-ordinates operating a Flight Log, their method offers more direct methods of computation and, therefore, is likely to be more accurate.

Two shaft rotations proportional to the two Doppler frequencies are thus available and these are converted into A.C. analogue voltages by means of precision tacho-generators. Such analogue voltages offer a very flexible means of computation for providing the outputs required from the system. In this case, the outputs are wind speed and wind direction —or, alternatively and on the same dials, ground speed and track, the required indications being selected by a switch. In addition, another unit shows rectangular co-ordinates in the form of counter indications related to the co-ordinates printed on the Flight Log chart. Other output quantities, such as latitude and longitude, or grid co-ordinates, may be provided if additional indicating equipment is used.

The system calculates wind speed and wind direction automatically, and stores these quantities. Should the signal be lost as a result of violent manœuvres the equipment automatically operates on memory and computes the required outputs from the stored wind information, true-airspeed input and heading input. Thus, provided the wind does not alter, the computation remains accurate on memory. An input of true airspeed and heading from the aircraft instrumentation is required, but the former quantity may be manually inserted. Any inaccuracy in the true-airspeed input will not affect the tracking accuracy of the system but only the accuracy of the wind rather than ground speed and drift, as the makers feel that the former arrangement is of more direct use.

The problem of compass accuracy and its effect on Doppler systems is not only due to the inaccuracy of the magnetic-heading indication (this is both a design and maintenance problem), but also the correct setting of the magnetic variation which applies in the particular area in which the system is being operated. The Flight Log presentation overcomes this latter difficulty by arranging for the variation quantity to be included with the chart orientation angle to form a grivation term. Variation corrections are thus incorporated in the chart design.

A pilot might begin a flight with his Decca Navigator serving the Flight Log. Doppler would during this time be switched on and any errors in its position indication checked against Decca. At the edge of the Decca coverage the Doppler indication would be accurately set on the Flight Log and thereafter followed until another area of Decca coverage was reached.

It would be the object of the Doppler equipment to bring the aircraft into the new Decca coverage area with sufficient accuracy to avoid any ambiguity when Decca was once again set up. The Decca Mk 10 receiver, with its automatic zone-identification, offers a very good chance of achieving this aim even after comparatively long flights. It can be foreseen that Decca and Doppler might in future be arranged to monitor each other continuously; but this is forward thinking.

Decca's Doppler equipment works in the X-band at about 8,900 Mc/s. It uses a long-pulse system with a pulse duration of three microseconds and repetition frequency of 45 kc/s. During pulse transmission the receiver section is inhibited. With such a system the aircraft might fly at an altitude at which the time required for the pulse to travel from the aerial to the ground and back again would be such that the pulse returned to the receiving aerial at a time when the receiver was inhibited. This would mean that at certain altitudes no Doppler signal would result. To avoid this, Decca sweep the repetition frequency between 40 and 50 kc/s at a frequency of about 50 c/s.

The power input required by Decca Doppler is about 300W and the peak transmitted power is about 20W. No very high voltages are used,

(Continued at foot of column 2, opposite page)

The Fedden Prescription

THAT vast sums of money have been wasted on abortive aeronautical projects since the war, that we are unprepared in the air today, and that there must be a radical change in the system which has led to our failures: these assertions are the theme of a book published last week in a declared effort to move public opinion.

Its author, Sir Roy Fedden, is one of the aircraft industry's most loyal supporters—and one of its most ardent critics. In the book, *Britain's Air Survival*,* he expresses his belief that the radical change can be initiated by setting up an independent tribunal to forecast how the relatively restricted, though proficient, resources of the industry can best be employed in the future. Speaking from the experience of a lifetime's work in the aircraft business, he feels that such a body would prevent the industry wasting both its own time and the taxpayers' money. By having "full authority to obtain all the information it needed" from the industry, the three Services and all Government departments and establishments, a tribunal could produce a report on how to plan our future.

This, one feels, is all very well in theory. But would such a report contain anything which the industry did not already know? Constructors have learned some very hard lessons in the last few years, and the rationalization which Sir Roy seeks is already taking place. It has been forced by the stark necessity to cut down expenditure, and today there is nothing like the multiplicity of projects which Sir Roy recalls were started after the war and so many of which proved futile.

It is highly questionable, too, whether firms, however much pressure or even compulsion was put upon them, would willingly give the tribunal "all the information it needed." One can hardly imagine a company which had, for instance, solved the practical problems that still prevent the principles of vertical take-off being fully applied, being fired with such public spirit that it would tell all. It might find the tribunal formulating recommendations based on its pioneer work, and consequently broadcasting its secrets to its competitors. Before such things could be allowed to happen the industry would have to be nationalized. And this is not the place to go into the advantages, or otherwise, of that.

But the industry will agree with many of Sir Roy's other major points. Particularly apt is his emphasis on the pressing need to provide technical staff to maintain, and produce results from, the facilities set up by both the Government and private companies. Rationalizing the industry would be pointless if there was insufficient staff to operate it. And these people must not all be just good designers, engineers and stressmen; there must be among them men of vision and personality who can lead the industry, and so retain in it the moral fibre which is so necessary for success.

If its warnings are heeded, *Britain's Air Survival* will promote action to make as certain as possible that there is no further waste of money or resources on unworthy projects. It is a serious indictment of British failures, and Sir Roy has gone to great pains to explain how other countries, particularly America, Germany and Russia are attempting to avoid, or have in the past avoided, similar errors. But it must not be thought that many British aeronautical firms have not already seen the need to stop wasting their effort. They have been carefully considering the proper course to steer. They have now changed to that course. Sir Roy's book should encourage them, and persuade public opinion to watch that they do not make any foolish deviations while carrying public funds in their pockets. A. C. B.

**Cassell and Co., Ltd., London, E.C.4. Price 11s 6d.*

FIREFLASH FOLLOW-UP

THOUGH a number of mechanical details of Fireflash remain security-cloaked, Fairey Aviation have now been able to release certain additional information concerning their air-to-air guided weapon and its production. Given below, it supplements the feature article which appeared in *Flight* last week.

Although the bulk of Fireflash production is concentrated at Fairey's Stockport factory, the output of experimental and development versions of an expendable missile must be on a semi-production basis, because of the numbers necessarily involved. Consequently, assembly at Heston is done to rate-fixed and piecework-bonus schedules, and there is a skeletal production line. Work on this scale may come as rather a surprise to minds attuned to the pre-production turn-out of aircraft, but many weapons-system problems can only be solved by having a sufficiency of missiles available.

Probably as a result of the announcement that Fireflash was to be adopted by the R.A.F. as a training missile, it is not always realized that it has passed acceptance trials as an operational weapons system. Fairey claim that when all functioning aspects of the system are considered—including storage, transport, serviceability and robustness under operating conditions—Fireflash is as good as any air-to-air weapon in the world. They are confident that the electronic anti-countermeasures built into the system are *operationally* effective (they are not claimed to be infallible, but enemy countermeasure equipment would probably be very heavy if it were to be effective during the few seconds while Fireflash was in flight), and a considerable number of direct hits have been obtained against pilotless Jindiviks and Fireflies. In any case, a proximity fuse in the Fireflash warhead makes it lethal at "a considerable distance".

Fairey are at pains to emphasize the importance of the engineering side of missile development, even to the extent of describing a guided weapon as "an integrated piece of flying-control design." They offer two illustrations of this over-simplification. The first is that the six equations used to calculate aircraft stability must also be applied to missiles—except that, instead of being split into two parts, they must all be applied simultaneously. Autopilot constants must also be taken into account. Resolution of these problems requires a simulator and a good deal of actual testing before the unknowns can be found. The other besetting difficulty is that, because there is no pilot to monitor the missile systems, reliability becomes of the first importance—and perhaps a hundred times more difficult than in an aircraft. The failure of a single joint, a single valve, a single gyro bearing will result in catastrophic failure.

To obtain reliability of this order, a very considerable amount of test gear is installed adjacent to the Fireflash assembly lines. Test philosophy was settled at an early stage in Fireflash development because of its resultant effect on the design. In service, the missile is tested by the relatively simple "go," "no-go" O.A.T.S. tester, and consequently the factory-finished product must be proved to a high standard to enable its service checks to be kept simple. During its tests, external power, artificial beam signals and simulated aerodynamic conditions are fed to the missiles, which are supported in simple rotating fibre jigs. As well as undergoing simple functioning checks, the missile is resonated by Goodman exciters and subjected to a bump test—a thump on the end from a suspended weight.

The environmental test shop contains, in addition to the mechanical rigs described last week, several for testing components to destruction. During a visit to Heston, we saw tip deflections of 1.5in being applied to a missile wing with a load of about 700 lb; the established fatigue life on a 1,000 lb load has been established as about 3,000 hr. On another rig an actuator assembly was cycled to destruction. The electro-pneumatic spool valves of this unit are very interesting; the extremely close tolerances required are obtained from a brass valve and lapped guide. The former has a multiplicity of pressure-balancing grooves and slightly underlaps the guide ports. There is thus a constant slight leakage of air from the high-pressure air bottle and the air passes through a two-micron porous metal filter. No silting of the valve occurs.

D.I.A.N. (continued from opposite page)

the maximum being about 950V. The equipment is unpressurized and can operate successfully up to 60,000ft. The aerial-transmitter-receiver, tracker-computer and indicator of the Decca unit together weigh about 80 lb. (The equivalent components of the American General Precision Laboratories PC-201 Radan, its nearest rival, are reported to weigh about 88 lb; Radan provides only ground speed and drift information.)

The Decca aerial unit would require a cut-out in the fuselage skin measuring 30in × 12in if mounted at a normal distance inside the skin. The aerial is designed to be stabilized in pitch up to ±20 deg, or less if the available space so demands; and stabilization reference signals could be taken from a master-reference gyro or an autopilot gyro vertical.

It is a characteristic of Doppler systems that the relationship between Doppler frequency and ground speed is dependent on the effective angle which the aerial beam makes with the ground. Although the actual angle between the beam and the ground may be held constant, the effective angle varies slightly according to whether the aircraft is flying over land or sea. This is due to an effect known as "beam distortion" or "water bias" and can lead to inaccuracies of quite a significant amount. In the Decca system a "Land/Sea" switch is provided.

Use of D.I.A.N. requires provision of a roll of charts for a given journey, these charts being suitable for Decca Navigator use in areas where such coverage is available, and for Doppler outside such areas. Transfer from Navigator to Doppler charts is simple and straightforward, and when the Decca Navigator is feeding the Flight Log the Doppler equipment remains fully operational, the position outputs being available continuously on the co-ordinates dials. Decca are now working on a computer which would convert Navigator hyperbolic co-ordinates into rectangular co-ordinates, so that a common chart could be used for the two systems.

A D.I.A.N. evaluation equipment, weighing approximately 170 lb, is expected to be ready for flying this year.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

The First Hangar

MY claim for the first use of a building as a hangar (as distinct from the use of the word "hangar," which the Oxford gives as being in *Henry Esmond*) is Lunardi's "advertisement" of 1784, in which he said:

"The gallery, oars, and wings are already made, and to be seen at the *Lyceum, Exeter-change, Strand*, where the Balloon is now conftructing and will be finifhed in about a fortnight."

London, W.1. F. H. SMITH,
Librarian, The Royal Aeronautical Society.

IN reply to friend Hurren (B. J.)
Sir, what do you think I should say?
Should I join with dear Geoff, who'd a spank
From the very first flyer, a Yank?
Or listen to Bill in a maze
Of his flights round the world in two days?
Or p'rhaps I could earn a few dibs with
That Harvard historian, our Gibbs-Smith?
Or should I be a little bit sharper
And write as Reporter the First, Harry Harper?
No. I think the occasion well warrants
Dignified silence.

Brighton, Sussex. PRITCHARD (JOHN LAURENCE).

I HAVE just seen the interesting letters about the first hangars. To be pedantic, the first aircraft hangar in actual use was the so-called *tent abri* with which Napoleon's *aerostiers* used to bed down their observation balloons in the year 1794: it consisted of a great tough sheet which was thrown over each balloon—kept inflated for economy—and then tethered to the ground like a tent, which of course is what it was. Built-up wind-breaks for balloons were in use certainly in 1785, if not in 1784.

Historically, the first proper hangar—i.e., an "architectural" structure specificially for housing aircraft—was designed in great detail, but never built: it was the remarkable and prophetic hangar that General Meusnier drew for his brilliant and equally prophetic dirigible airship (also unbuilt) in 1785: the unique detailed drawings are still preserved in Paris.

I have a feeling that Santos Dumont's first airship shed was built in 1901; at least I have a photograph of a shed of his taken when under construction in July of 1901. I think priority in airship sheds (practical sheds built for the airships) must go to Zeppelin, who built his great floating shed on Lake Constance in 1900 for his first dirigible.

Harry Harper is certainly correct in his claim for Lilienthal, who built the first shed specifically for gliders on top of his artificial hill about 1893. Next came the Wrights, who erected a tent tied to an oak tree at Kitty Hawk in 1900 to house themselves and their first glider. Then, in 1901, they built a frame hangar especially for their gliders four miles or so south of Kitty Hawk at the Kill Devil Hills: here they housed their gliders of 1901 and 1902, and their powered machine of 1903.

The first hangar on the first specific airfield for powered aeroplanes was the Wrights' wooden hangar on the Huffman Prairie (pasture), some eight miles east of Dayton, which was completed in April 1904.

London, W.1. C. H. GIBBS-SMITH.

Belgian Enterprise

ACCORDING to *Flight* of July 26 (page 101, "Pressing on at Gatwick") this airport will be the first in the world to combine air, rail and road transport. Contrary to most information appearing in *Flight*, this is wrong. Brussels Airport has been connected with the city of Brussels for more than two years by direct rail services, by helicopters and, of course, by a road which you might call a "super-highway." In addition, for boating fans, the Brussels-Antwerp Canal is only two miles away from the air terminal.

Brussels. R. LECOMTE,
Director General, Régie des Voies Aériennes.

No Complaints

I WAS most interested to read the letter from Mr. Norman Jones. While agreeing with his remarks I would like to make the point that only a few weeks ago the Ministry granted us permission to carry out aerobatics over Croydon Airport during our At Home. An excellent display of aerobatics was put on by the team of Czech pilots and by some of our own members, and this was much enjoyed by all present. At no time did the pilots go higher than 1,200ft above aerodrome level, nor did they go outside the aerodrome boundary.

As far as I know there were no complaints from local inhabitants, and we even received two letters of appreciation. We are hoping to make this display an annual event.

Croydon, Surrey. A. SPROXTON,
C.F.I., Surrey Flying Club.

Apache Demonstration

LAST week the latest American Piper Apache to arrive in this country was demonstrated before a large number of company representatives and Government officials at Croydon Airport. The aircraft was handled by Captain A. C. Morgan, who had brought it across the Atlantic on its delivery flight.

The demonstration last week was arranged by Irish Air Charter, Ltd., of 62, Merrion Square, Dublin, who have been recently appointed the sole distributors for Piper Aircraft Corporation of Lock Haven, Pennsylvania. The price of the standard Apache is $34,990. The aircraft is also available in two de luxe forms, the "custom" model at $37,945 and the "super custom" at $39,755. For delivery in the U.K. there is an additional charge of approximately £1,000. Irish Air Charter are negotiating with the A.R.B. for the requisite approved maintenance schedules and clearance is expected shortly.

Dufaylite French Applications

FROM Dufaylite Developments, Ltd., 24 Coleman Street, London, E.C.2, comes information about Dufaylite honeycombs being used in the construction of several French aircraft, including the E.C.A. 56 target and the Sud Aviation Djinn helicopter.

The body of the E.C.A. 56, which has been described [in *Flight* for May 31 last, p. 742] as "in every way (even to colour) reminiscent of a goldfish," is of sandwich construction. The core material is glassfibre Dufaylite honeycomb of 10 mm cell size and 8 mm thickness, impregnated with polyester resin; and the laminates are of glassfibre materials stabilized with polyester resin.

In the Djinn, Dufaylite—which for French applications is manufactured by the company's licensees, Construction Carton Bois, 57 Rue Pierre Charron, Paris, 8e—has been used as core material in the construction of the rotor blades.

Appointed aircraft sales manager of I.V. Pressure Controllers, Ltd. on his retirement from the R.A.F., A. Cdre L. R. S. ("Dick") Freestone, O.B.E., A.F.R.Ae.S., formerly Director of Aircraft on the M.o.S. staff in Washington, is here seen receiving a F.100 Super Sabre model from Mr. A. T. Burton, vice-president of North American Aviation.

Mr. A. M. A. Majendie (left) and Mr. L. C. Harman, who (as reported on p. 242) have been appointed directors of Smiths Aircraft Instruments, Ltd.

PUTTING *MEANING* INTO DEFENCE

A new dimension of sea safety

The Canadair CL-28 is the most formidable search, strike and kill maritime patrol weapon in the air today. It is in quantity production for the Royal Canadian Air Force and is available for purchase.

The CL-28—a direct derivative of the Bristol Britannia—carries the most comprehensive collection of electronic and other detection equipment ever assembled into one aircraft for locating, tracking and 'fixing' enemy submarines—whether submerged, 'snorting', or on the surface. Once contact is made, torpedoes, depth bombs and other offensive weapons are released.

It was specifically designed for long periods of ocean patrol duty . . . tactical coordination with naval surface craft on defensive and offensive manoeuvres . . . convoy and search-rescue operations.

The CL-28 will meet or surpass the requirements of friendly countries responsible for the defence of coastlines and sea approaches. For full information, contact our European representative or write directly to vice-president/sales.

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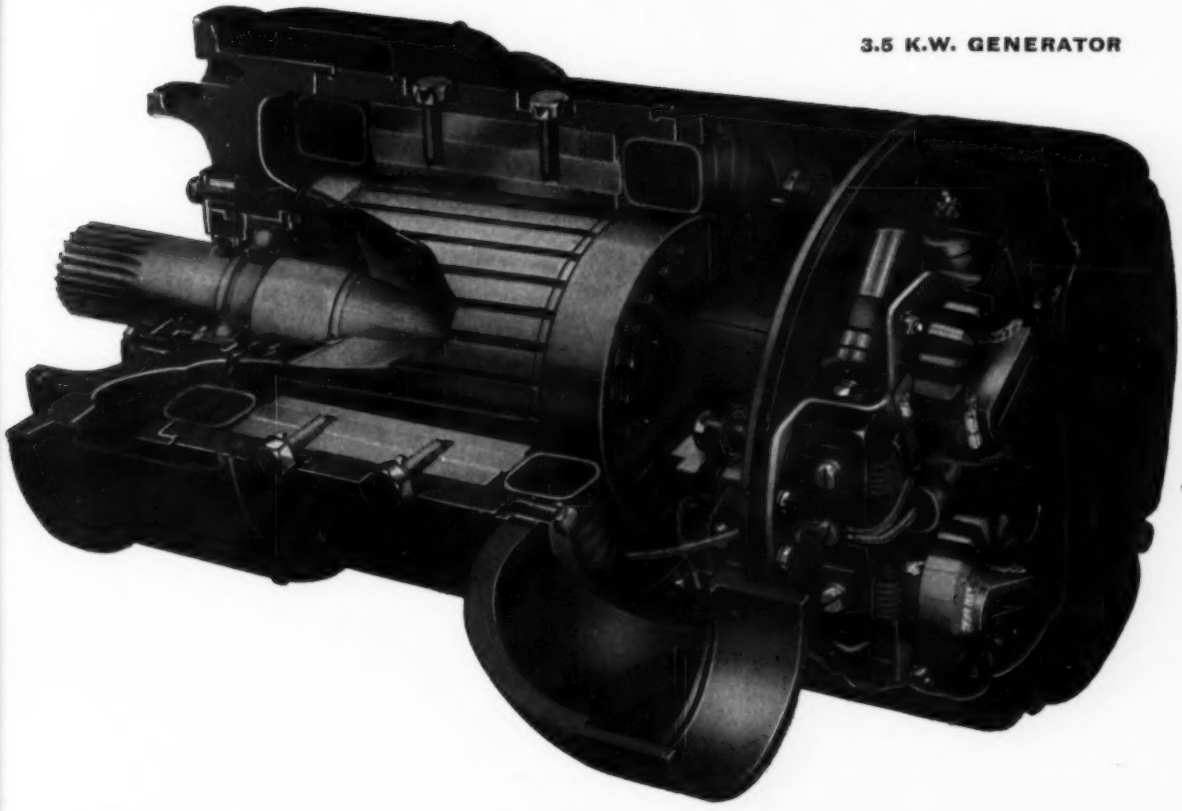

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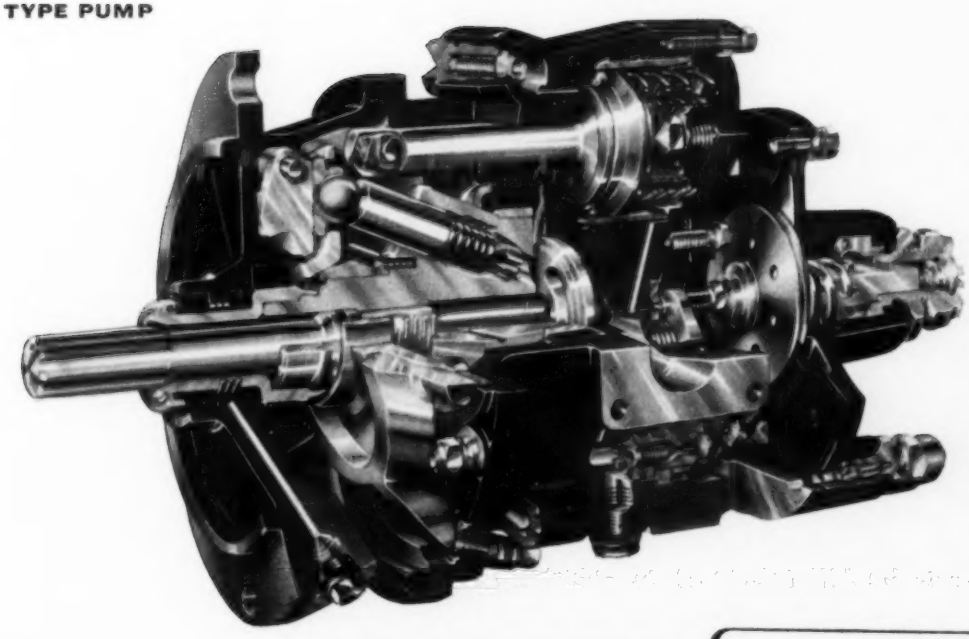

LUCAS ROTAX

WINGS DAY
SEPT. 14th
GIVE FOR THOSE WHO GAVE

From a painting by Roy Cross

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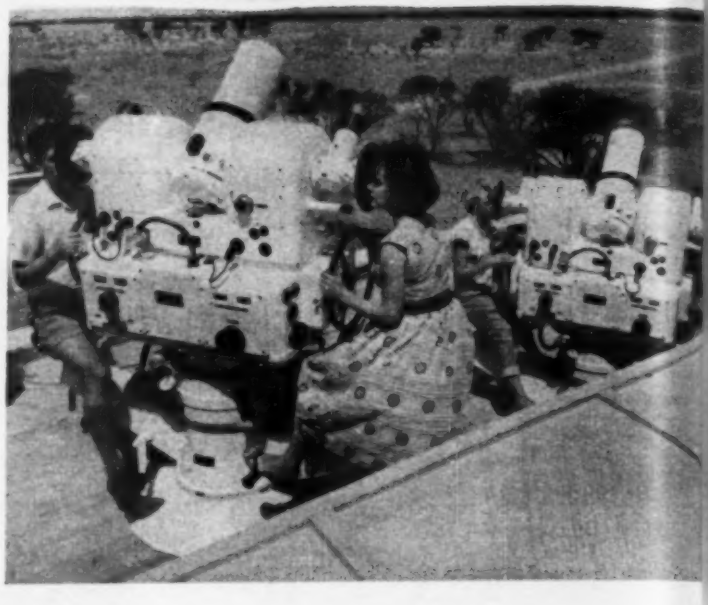
Commonwealth Aviation 1957

WIDESPREAD facilities, contrasting problems, a common enthusiasm and high level of ability—all these are reflected in this year's Commonwealth aviation scene. On the manufacturing side, the main subject of this special issue, Canada's complex and vigorous industry reports steady progress and a widening of activity—plus recurrent problems of fluctuating levels of production. Australia's decision to work closely with the U.S.A. has still not been followed by a statement on the country's major defence programme—that for a fighter to replace the Avon Sabre. Australian aircraft-industry manpower has been drastically reduced over the past twelve months, and the industry is marking time. In India, by contrast, the manufacture of aircraft and engines is an expanding business. Other aspects of the aviation scene reported in this issue include the progress of Australia's air transport, which continues to thrive; the activities of the Weapons Research Establishments in South Australia; and the operations of some of the Commonwealth Air Forces. The overall picture is of a considerable contribution to the world's total aeronautical effort. It is a contribution of which too little is generally known.



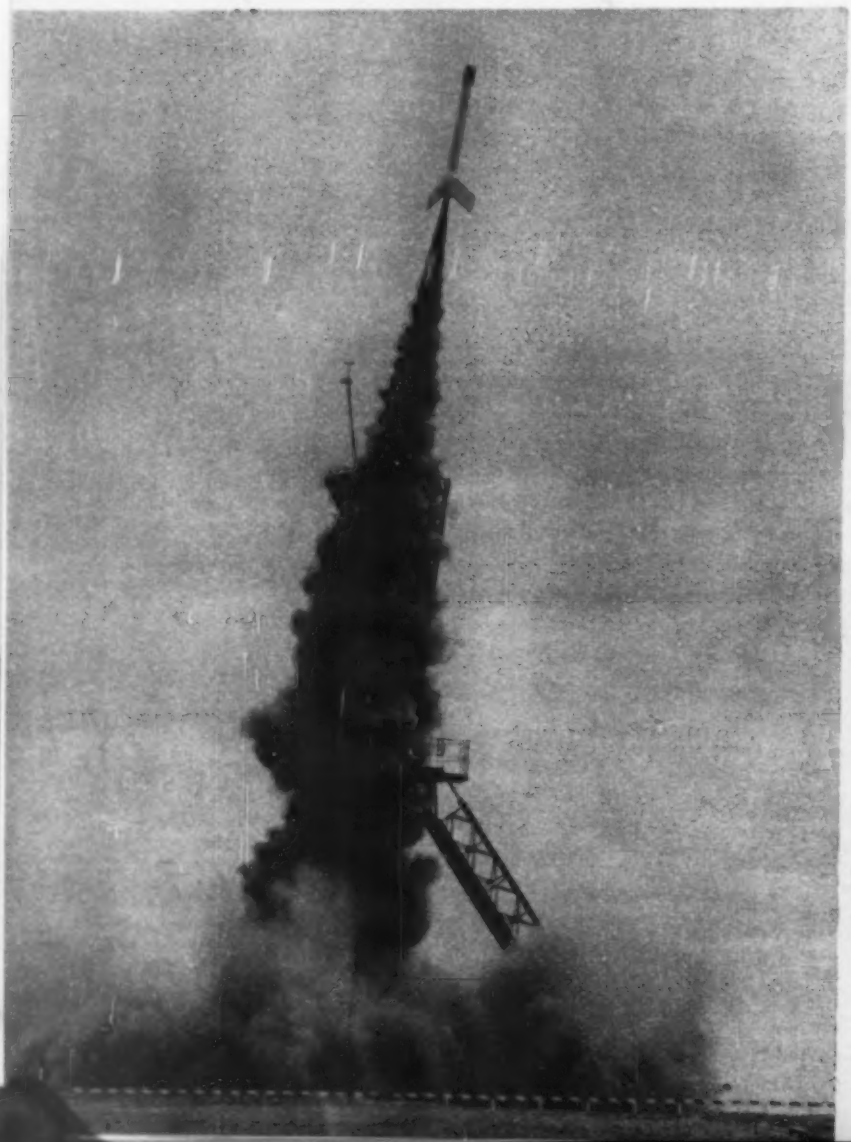
Operation of a kinetheodolite installation on the guided-missile range at Woomera, South Australia.

AMONG the organizations of the British Commonwealth engaged in the development of weapons for defence, the position of the Weapons Research Establishment, with its unique facilities for testing guided weapons, is now firmly established. Since its beginning in 1946, the establishment has built up a staff of nearly 3,000, 600 of whom are permanently stationed at Woomera. This has been done in accordance with a policy for the development of guided weapons systems agreed to between the British and Australian Governments, in which Australia, whose geographical features are so suitable for the purpose, undertook to provide facilities for testing the weapons and for analysing the test data.

An account of the establishment at Salisbury and Woomera was published in *Flight* for August 26, 1955, since when development work at both places has proceeded apace.

Progress in Weapons Research

CURRENT DEVELOPMENTS AT SALISBURY AND WOOMERA, SOUTH AUSTRALIA



Guided Weapon Trials. In the guided-weapons field some of the results of the joint United Kingdom/Australia project work have recently been announced by the Ministry of Supply. The air-to-air beam-riding weapon Fireflash has successfully completed acceptance trials and those of the infra-red homing weapon Firestreak are in hand. These trials have involved the R.A.A.F. and members of the United Kingdom Joint Services Trials Units in work under a wide range of test conditions.

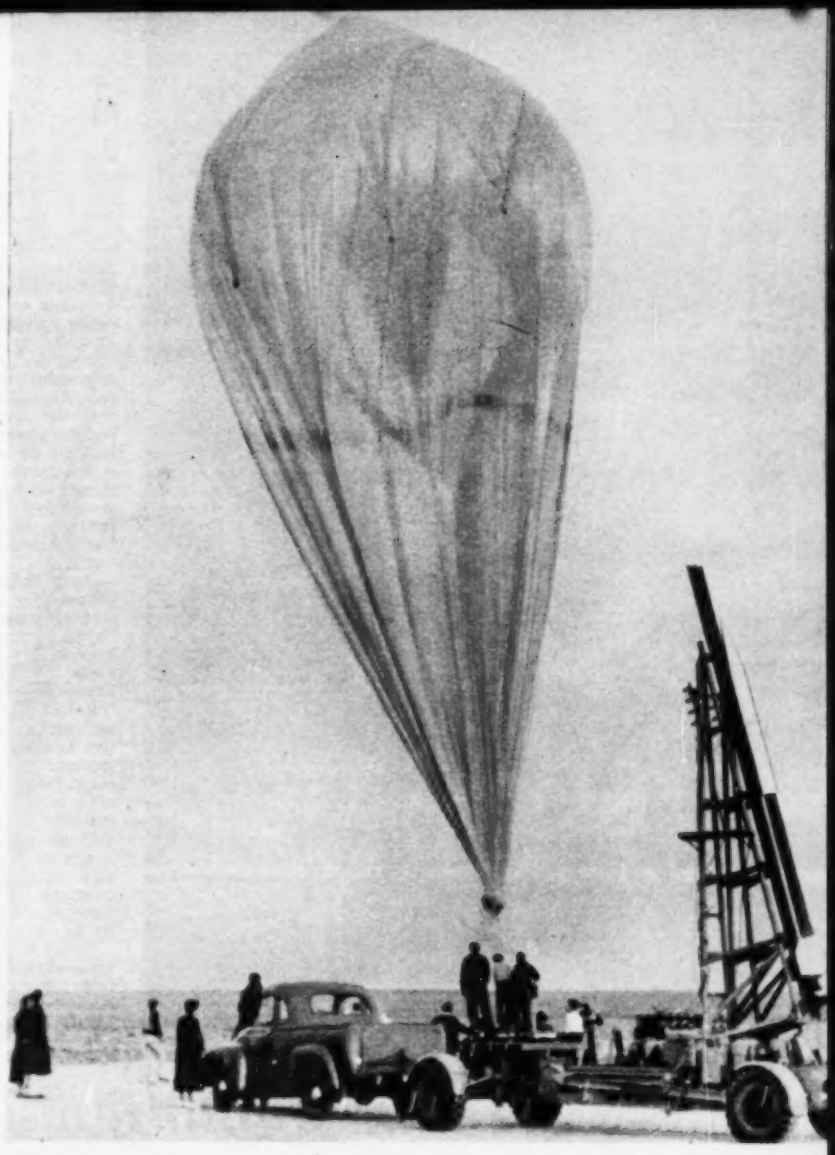
The R.A.A.F. at Edinburgh Airfield, adjoining the Salisbury premises of the Weapons Research Establishment, continues through its Air Trials Unit to carry out the flying programmes demanded by the trials. These programmes involve not only conventional aircraft but also Jindivik, the high-speed pilotless aircraft used as a target for anti-aircraft weapons and droned Meteor aircraft. The success of the Australian-developed Jindivik in this rôle has led to a number being acquired by the Ministry of Supply for trials in the U.K., and to others being purchased by the Government of Sweden.

Apart from its work in the guided-missile testing programmes, Edinburgh Airfield continues to play an important part in the mounting of atomic-weapon trials at Maralinga.

Comets of R.A.F. Transport Command have recently supplemented Hastings aircraft in providing a fast shuttle service between Lyneham, Wiltshire, and Edinburgh Airfield for the transport of material for trials.

Continuous pressure has been maintained on the Weapons Research Establishment organization to extend the technical facilities both on the ranges and at Salisbury. As the ground range of new weapon projects increases, so new areas are being explored and surveyed. Laying-out and constructing roads and buildings, airstrips, lines of communication and water supplies, the planning of impact areas and the disposition of instrument sites with regard to them and the main trajectory, demand a continuing effort in civil, mechanical and electrical engineering works as well as in the laboratories producing the equipment.

Taken last month at Woomera, this impressive photograph shows the launching of a Skylark high-altitude rocket, designed by the R.A.E. These firings form part of the I.G.Y. programme.



The "rockoon" device HARP—a balloon/rocket combination—being prepared for launching.

A new and remote meteorological station at Giles, near the centre of the continent and some 600 miles from the nearest town, now provides a continuous weather reporting service.

Data Reduction. Recently the Weapons Research Establishment has been host to visitors from the U.K. and U.S., and from all parts of Australia, at a conference on data processing and automatic computing machines. Because of the immense amount of data recorded on a variety of media during trials by the many instruments deployed on the range, only a very sophisticated data-reduction system which takes the greatest advantage of the high-speed automatic techniques available could hope to accommodate the load within an acceptable time. Over a period of years such a system has been developed and is now in daily use. It is built around a high-speed digital computer known as WREDAC built by Elliott Bros. of London.

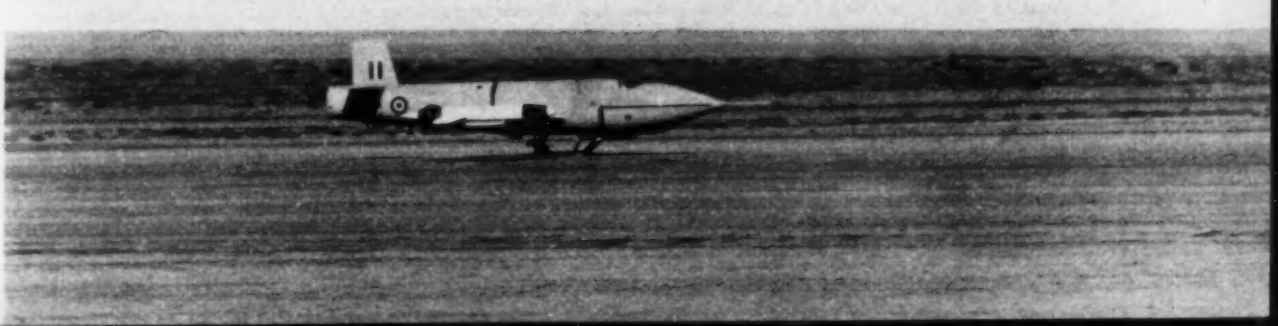
International Geophysical Year. In support of the scientific work of the International Geophysical Year, several projects have been undertaken by the establishment to probe the upper atmosphere. A number of firings of the Skylark rocket have taken place this year, and a further series are to be held at Woomera in accordance with the research programme arranged by the Gassiot Committee of the Royal Society.

The "rockoon" device HARP will be launched in accordance with the requirements of Australian research institutions. In this case the rocket will be carried by balloon to a height of eight or nine miles before firing, and the considerably reduced air-resistance at such altitude will enable it to reach heights of about sixty miles, some four times higher than could be achieved by firing the same rocket from the ground.

In addition, an active scientific contribution will be made by Australia in connection with space satellites. Optical and radio observing apparatus provided by America is being installed and will be operated by W.R.E. staff. Installation of the 20in Baker-Nunn Schmidt type of camera will shortly commence and towards the end of the year the "Minitrak" electronic tracking system will be in operation. This will track the satellite by radio and record telemetered data. The residents of Woomera have volunteered to help, through "Moonwatch," by keeping the satellite under observation at critical times.

General Research. In addition to such work, the Australian Government continues with a programme of research and development in allied fields required for defence. This work is spread over several establishments. At the Weapons Research Establishment at Salisbury special laboratories are devoted to projects in the fields of electronic research, rocket propulsion materials and motors, and high-speed aerodynamics. Research in this latter field will receive a substantial boost from the recent completion of a supersonic wind-tunnel working in the Mach number range 1.4 to 2.8. This work will supplement the free-flight trials carried out with the aid of the range facilities at Woomera, in which aerodynamic models and shapes are boosted to supersonic speeds in free flight by rockets.

Left, the Weapons Research Establishment Digital Automatic Computer (WREDAC)—part of the data processing installation at Salisbury. Below, a Jindivik target aircraft lands on its skid at Woomera.



iron-ore, heavy engineering, industrial refrigeration and many other operations. Even accessory manufacturers are looking beyond the aircraft industry, as is described in the following pages.

All this, of course, is an attempt to find a stable market; but it is also the most obvious means of achieving increased turnover and thereby maintaining employment at the level of the boom years of 1952-5. The floods of Sabres, T-33s and CF-100s have dwindled to a trickle and although today's aeroplanes are *per capita* appreciably more expensive, their numbers are insufficient to make up the difference. Smaller numbers of aircraft make life particularly hard for the people who supply small items—at a substantially fixed price—such as instruments, valves and so forth. Throughout Canada one can detect a note of bitterness that the Department of Defence Production has frequently bought a mass-produced item in the U.S.A. because the latter happens to be a few cents cheaper than the native product. It is natural that aeronautical trade between America and Canada should be considerable; but in the southward direction the flow is crippled by the American import tariff of 15 per cent, which restricts the Canadian small businesses to the Dominion's own fairly limited market and thereby increases their prices still further.

As in Britain, lack of money has made the selection of major government programmes an onerous task. By far the largest is that concerning Avro Aircraft's CF-105 Arrow, a mighty "bisonic" two-seater all-weather fighter to succeed the CF-100. Superficially the programme would appear to be uneconomic unless a market for this aeroplane can be developed outside the Dominion; but from the engineering viewpoint it represents a colossal achievement of which every Canadian should be proud—and we may couple with the Arrow the name of its powerplant, the Iroquois, by Orenda Engines. The second-largest programmes are those undertaken by Canadair for the big Argus ocean patroller and the CL-44 long-range transport. Canadair are a large and capable firm and are putting through both programmes precisely on schedule. Another substantial contract is that placed by the Royal Canadian Navy for 100 licence-produced Grumman Tracker anti-submarine aircraft for which de Havilland is the prime contractor. This is the only Canadian company who have achieved substantial commercial output and their prosperity should be enhanced by the forthcoming Caribou, by far their most ambitious project to date.

In the field of guided weapons Canada has abandoned her own air-to-air missile and is producing the Sparrow 2 under licence from Bendix. Sparrow 2 seems a curious choice of weapon, particularly since it could hardly be made available to the R.C.A.F. before the end of next year, and it is inconceivable that this weapon should be the whole *raison d'être* of the Arrow. Moreover the former defence minister, Ralph Campney, revealed recently that Sparrow was the only guided missile to be manufactured in Canada and that no discussions were under way concerning any other non-Canadian missiles.

Whatever the final outcome may be and however Canada's pattern of defence may change during the ensuing decade, the problems facing both her armed forces and industry are immense. It is not widely known that the area of the Dominion is roughly twice that of the U.S.A. and the provision of effective air defence has necessitated tremendous expenditure on long-range early-warning radar chains such as the DEWline, the Mid-Canada Line and a number of other "chains" and "fences," the whole being controlled from a unified North American headquarters at the home of the U.S.A.F. Air Defense Command at Colorado Springs. Over the next few years Canada will be faced with the problem of maintaining this enormous defensive network in top-notch condition, and the Suez operation (in which the R.C.A.F. was responsible for the air lift of U.N.E.F. troops) emphasized the necessity of rebuilding her logistic air-transport forces.

It seems obvious that transportation, particularly on the embryonic routes in a north/south direction, is one of the keys to the future expansion of Canada. Decisions must be taken soon if the Canadian industry is not to be faced with the dismal prospect of sitting back and watching the importation of masses of new aircraft from abroad. Already the lack of official sponsorship has deprived the Dominion of any home-built helicopters and there are several other fields in which complete reliance has to be placed on manufacturers outside Canada. Nevertheless the position is steadily improving and the increasing willingness of British and American industry to establish plants and subsidiaries on Canadian soil is also increasing the proportion of Canadian-built equipment carried by Canadian-built airframes.

The Canadian Industry

IT is our custom in this issue to introduce the section dealing with the Canadian industry with a dissertation in general terms upon the overall aeronautical scene in the Dominion. Each year since our first Commonwealth issue this has been based on first-hand impressions gained by *Flight* writers who have visited Canada for this purpose—and this year's review, written by the Technical Editor, is no exception. It is particularly appropriate that such a survey should be attempted at the present time for it affords an opportunity of ascertaining to what extent, if at all, the aircraft industry of Canada is suffering from the problems which are besetting our own industry.

In our 1956 review we commented upon the trend then already strongly apparent towards an intensification of engineering and research effort among the majority of Canadian companies at the expense of appreciable declines in manufacturing man-power. This trend is, of course, by no means peculiar to Canada, nor to the aviation industry. During the past year it has become accentuated and it is possible to discern a second trend which follows logically from the first. The Canadian industry is earnestly searching for a chance to achieve greater stability and it sees increased commercial (i.e. non-military) business as the principal means to this end. Just as in Britain, many Canadian companies are also seeking to broaden the whole scope of their operations and to move into non-aviation fields whenever they can find an opening.

As evidence of this it is pertinent to cite the case of Canadair who are now rapidly expanding their operations in the field of nuclear research and production, and also hope to achieve great success with an articulated tracked vehicle for the Canadian Army—originally designed as a snowmobile for use in the Arctic. A. V. Roe have diversified themselves with a vengeance and now count the manufacture of aircraft and engines as merely one facet of an industrial complex which embraces road and rail vehicles,

FAIREY Fireflash

The first British guided weapon.

Now with the Royal Air Force.

A Vickers Supermarine Swift fitted with two Fireflashes.

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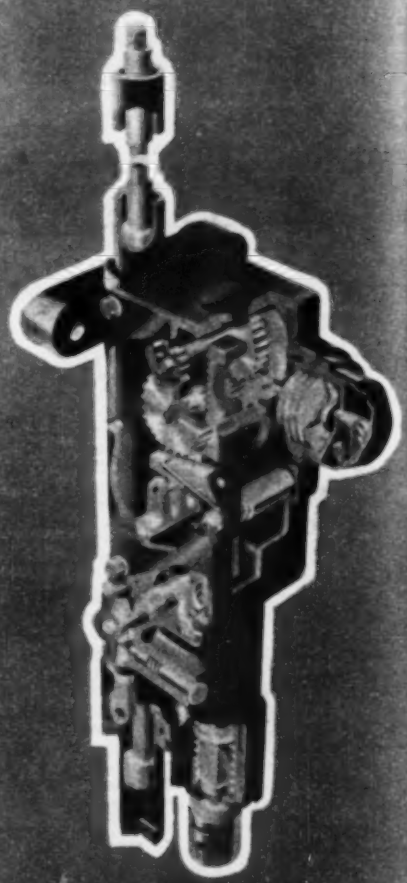
Martin-Baker Mk.4 Fully Automatic Ejection Seat.



MARTIN PATENT TIME RELEASE MECHANISM

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Although the rate of delivery of the CF-100 Mk 5 is less than that reached with the Mk 4, aircraft are still leaving the big Avro plant at Malton at a substantial rate. This Mk 5 bears the serial number 700, the first machine having been number 101. The photograph was taken one month ago. Noteworthy features include the guards over the radar nose and engine intakes, and the extended wings and tailplane.

The Canadian Industry . . .

A. V. ROE CANADA, LTD.,

170 University Avenue, Toronto.

STARTLING things are happening within the ever-widening orbit of this famous company. Originally a comparatively modest offshoot of the British Hawker Siddeley group, it is now the parent of a family of industrial enterprises which is perhaps growing more rapidly than any comparable organization in the world. Even the field of aeronautics is too small to contain it, and it is today spreading into almost every field of industrial technology.

Among the largest of A. V. Roe Canada's wholly-owned subsidiaries are Avro Aircraft and Orenda Engines, which are described below together with Canadian Steel Improvement and the Canadian Car Company (previously Canadian Car and Foundry). The foundry side of CanCar's business has been reorganized as Canadian Steel Foundries (1956), Ltd., and another offshoot is Canadian Steel Wheel, Ltd., organized in partnership with the English Steel Corporation.

In March of this year Avro purchased Applied Research, Ltd., this company was previously P.S.C. Applied Research, and was one of the Hunting Group of companies. In May Avro purchased no less than 150,000 shares in the giant Algoma Steel Company, and a ninth subsidiary, Canadian Thermo Control Co., Ltd., was acquired on July 18. Discussions are now in hand upon one of the most gigantic industrial deals in recent years—an offer worth about £40m as a take-over bid for Dominion Steel and Coal, one of the greatest Canadian industrial concerns. The offer was due to be made by one week from today, August 30, and to remain open for 30 days thereafter. In order to provide a centralized headquarters from which to administer this giant empire, A. V. Roe Canada have moved into a new headquarters office on University Avenue in down-town Toronto.

The basic company has now been trading for almost twelve years. As in previous years the chairman is Sir Roy Dobson, and Crawford Gordon Jr. is president and general manager. During the past two years the company's operating subsidiaries have purchased more than $20m-worth of government plant and machinery and equipment and now own virtually all their capital installations.

Avro Aircraft, Ltd., *P.O. Box 4004, Terminal A, Toronto.*

Having cut their teeth firmly with the design, development and production of the big CF-100 all-weather fighter, Avro are now bearing an enormous engineering load with the CF-105 Arrow (probably the largest single aircraft-development programme in the British Commonwealth), as well as the incredible Weapon System 606A for the U.S. Air Force and a range of even more radical projects so far ahead of anything at present flying that they border on the realm of fantasy. Total plant area at the company's headquarters at Malton, Ontario, is at present 1,684,946 sq ft, a recent major addition being 20,000 sq ft added to the flight-test building. Total employment has climbed back to 9,800 from a minimum of some 8,200 last year.

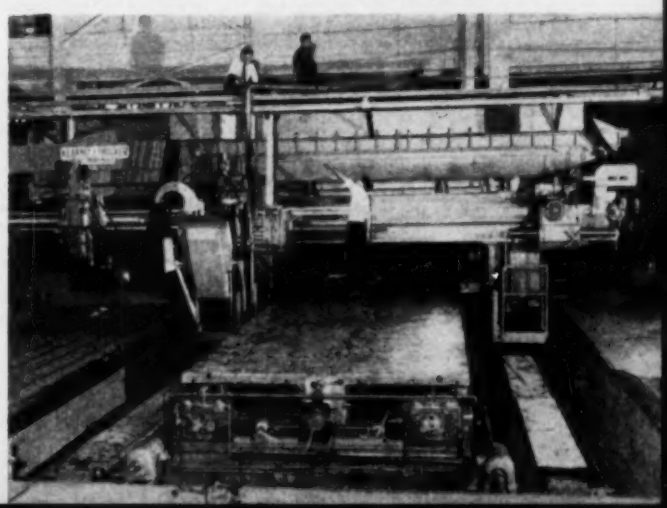
CF-105 Arrow. Security regulations preclude discussion of this remarkable aircraft in detail, but sufficient is known of it to form a preliminary assessment. It has been developed since 1952 as a replacement for the CF-100 in the rôle of long-range all-weather fighter for the defence of Canada. It is understood to be a delta-wing aircraft powered by two large turbojets with afterburners, crewed by a pilot and navigator and equipped with missiles. Air Marshal C. R. Slemon, Chief of Air Staff of the R.C.A.F., recently said:

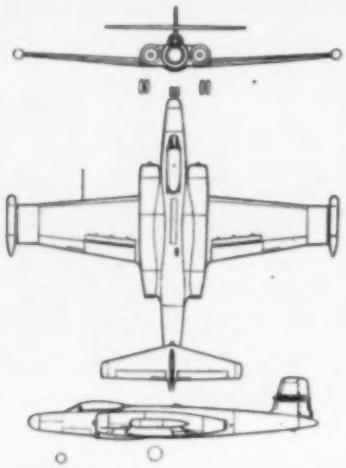
"The Orenda engine powers our 17-ton CF-100 intercepter up to altitudes of 8 or 9 miles above the earth in something like 7 or 8 minutes; a creditable performance, believe me. Compared with the CF-100 our newest all-weather intercepter, the Avro Arrow, will weigh twice as much, but the Iroquois engine will power it to altitudes four or five miles higher; it will get up there in about half the time and it will fly at better than twice the speed . . ."

The Arrow Mk 1 has been reported to be powered by two Pratt and Whitney J75 engines, and the first of these aircraft is scheduled to start its flight trials before the end of this year. Development of the Arrow has involved tremendous engineering effort with regard to structure, materials, tooling, environmental research, systems, accessories and even human factors. It was recently unofficially asserted that the basic development of the aircraft has absorbed $200m.

CF-100. More than 600 of these exceedingly capable two-seater, twin-engined, long-range, all-weather fighters have now been manufactured and the production lines remain in-being, although the rate of delivery is but a fraction of what it once was. For several months past the principal production variant has been the Mk 5, the tailplane and wings of which are of greater span than those of the Mk 4 in order to confer improved high-altitude performance. The wing extensions comprise parallel-chord sections measuring some 3ft in span added to the tips of the original wing. As a result the design factors of the Mk 5 wing are lower than those of the previous aircraft, and stringent restrictions on the handling of the Mk 5 are imposed at altitudes below about 10,000ft. It is reported to be non-adherence to these restrictions

Typical of the giant tooling which Avro have had to buy in order to make the CF-105 Arrow is this Kearney and Trecker skin mill, which measures 28ft by 9ft across the table. It has already machined a large number of Arrow wing panels and represents a huge capital investment.





Avro Aircraft CF-100: Powerplant, two Orenda 11; span, 56ft; length, 54ft; gross weight, about 37,000 lb; max.speed, about 660 m.p.h. (Mk. 5 version is shown.)

Orenda Engines' Iroquois engine was "unveiled" early last month: left to right are Air Marshal C. R. Slemon, R.C.A.F. chief of staff, Mr. George R. Pearkes, V.C., Defence Minister, and Mr. Walter R. McLachlan, Orenda president.

The Canadian Industry . . .

which has been responsible for structural failures in CF-100s in squadron service.

In spite of its additional airframe portions the Mk 5 is lighter than the Mk 4, largely as a result of the deletion of the fuselage gun-pack. Armament thus comprises 52 spin-stabilized air-to-air rockets in each of two wing-tip pods (104 in all). Small numbers of Mk 5s are being delivered to the R.C.A.F. and a total of more than 50 aircraft are to be delivered to the Belgian Air Force for use as a standard all-weather fighter. The Belgian contract is worth $43m and is being financed jointly by the governments of Canada and the U.S.A.; it is doubtful whether the aircraft concerned will actually be additional to those for which contracts were previously held.

Development is continuing upon the high-performance missile-carrying CF-100 Mk 6. The structure of this version will be substantially the same as that of the Mk 5 but increased high-altitude thrust will be provided by a degree of afterburning applied to the two Orenda engines. Armament will comprise the Sparrow 2 beam-riding missile (which has been adopted as standard by the R.C.A.F.) and a completely new fire-control and radar system will be incorporated to suit the needs of this weapon. Experimental firing trials are at present being conducted at Cold Lake and in the U.S.A.

WS-606A. In 1951 Avro Canada (as it then was) conceived a revolutionary type of aircraft with a "horse-shoe" geometry such that it was immediately dubbed a "flying saucer"; the device was known by the company designation Project Y. In 1955 the U.S.A.F. announced that it had purchased the complete rights to the design and the development of the concept has since been undertaken by Avro under contract to the U.S.A.F. Air Research and Development Command, under the management of an Englishman, John Frost. Present developments are labelled "secret" but they are clearly well into the hardware stage.

Orenda Engines, Ltd., *P.O. Box 4015, Terminal A, Toronto.*

In our 1956 review we commented on the fact that the rate of delivery of Orenda turbojets had been reduced from 100 engines per month to a total of 40 per month when the 3,000th engine was delivered in May of that year. Since that time deliveries have been further decelerated to approximately one engine per working day; approximately 4,000 Orendas have now been delivered for the CF-100 and the Sabre 5 and 6, and production will continue throughout 1958, principally to meet the export orders for Belgium and Western Germany. Production is divided fairly evenly between Orenda 11s for the CF-100 and the slightly more powerful Orenda 14 for the Sabre (the engine was last described in our world engine review of July 26 last). A proportion of the contracts for CF-100s concern the Mk 6 aircraft, which will have a moderate-augmentation type of afterburning.

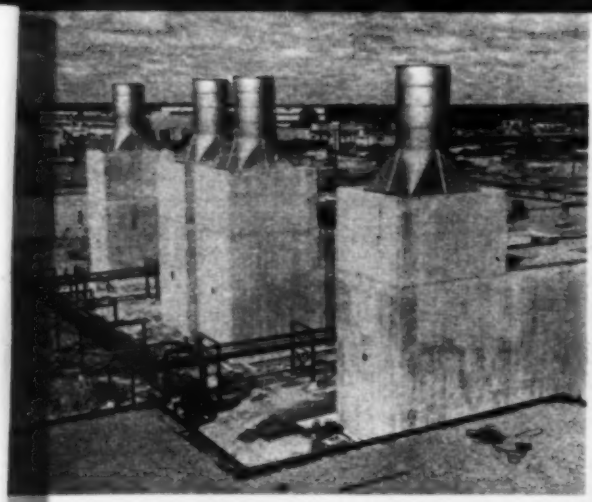
Succeeding the Orenda is the Iroquois, one of the world's most powerful engines and an exercise in advanced design which would test the strength of any engine company in the world. The engine is a medium- to high-pressure two-spool unit, and not the least among its unusual features is the extraordinarily high proportion of titanium and titanium alloy which has been employed for primary structures and detail parts; the new alloys represent about 20 per cent of the finished weight of the engine. Partly owing to this widespread use of such an intractable and little-known material the development problems which Orenda have suffered have been considerable, but experience during extensive bench trials is now such that the remainder of the engine's history should be relatively straightforward.

Orenda were given instructions to proceed on Project Study 13 in January 1954; the first engine went on to the bed on December 3 of the same year and was first run fourteen days later. At least six Iroquois engines have run, and flight-testing is now beginning with an engine mounted on the starboard side of the rear fuselage of a Boeing B-47 (picture, July 26, p. 121). Loaned to the R.C.A.F. by the U.S.A.F., the aircraft was converted by Canadair at Montreal. It was delivered with a mock-up Iroquois of the correct configuration and weight on April 15, since when it has completed about eight hours' flying with the mock-up installed. The mock-up has now been replaced by a real Iroquois, with extremely extensive instrumentation.

The company's $7.7m engineering expansion programme announced 18 months ago is now largely complete. Six new test cells arranged in three pairs, each capable of running an advanced Iroquois with afterburner, are in the final stages of construction adjacent to the main manufacturing plant at Malton, Ontario; the first cell was run with an engine in the spring of this year and all are scheduled to be in operation next month. An even greater capital investment has been required by a completely new high-altitude test facility for complete engines which is scheduled to go into operation at the end of the year. Further expansions of test facilities have been made to the research establishment at Nobel, 160 miles north of Malton, some 20,000 sq ft of new test cells for cooled blades and reheat systems having been brought into operation almost a year ago.

No appreciable change in employment at Orenda has taken place

A 10-ton Massey drop hammer of Canadian Steel Improvement Ltd., engaged in the forging of titanium compressor discs for a large turbojet.



Six new test cells recently commissioned at Orenda Engines could each take on engine with 150 per cent of the mass-flow of the Iroquois. Water cooling is provided for reheat runs. Behind is the plant of Avro.

in the past twelve months, the pay-roll having stabilized at about 5,000. Total manufacturing floor-space remains 825,000 sq ft, and the engineering and experimental area is now about 460,000 sq ft at Malton and 85,000 sq ft at Nobel. Orenda's president and general manager is Walter R. McLachlan.

Canadian Car Company, Ltd. (*Headquarters*) *621, Craig Street West, Montreal 3;* (*Plant*) *P.O. Box 67, Fort William, Ontario.*

At Fort William, CanCar's contribution to the CS2F Tracker programme is the construction of the complete centre-section and outer wings. Also undertaken for the Canadian de Havilland company is the production of wings and tail assemblies for the D.H.C. Otter.

Probably the most lucrative production at present is that of Harvard spares. Exclusive world sales rights (excluding U.S.A.) for Harvards and spares are held by CanCar, and the volume of spares supplied to world-wide customers has increased continuously over the past two years.

Following the manufacture of 125 Beech T-34A Mentors for the R.C.A.F. and the U.S.A.F., a new agreement has been negotiated this year between CanCar and the Beech Aircraft Corporation. This concerns Canadian manufacturing rights for the Beech T-73 tandem jet trainer, which in May of this year was evaluated by the R.C.A.F. At present it is an eligible contender as a Harvard replacement for the Service.

Canadian Steel Improvement, Ltd., *41 Horner Avenue, Etobicoke, Ontario.*

In spite of their title this company is particularly renowned for its prowess in the forging of titanium. Precision forgings in a variety of titanium alloys are in bulk production for numerous Canadian and American aircraft and aero-engine companies and the volume of business is still expanding. A typical example of C.S.I.'s work in this field is their production of precision-cast compressor blades for the Iroquois. During the past year a further three heavy presses have been installed for the production of titanium forgings and the photograph on page 258 shows the manufacture of forgings for compressor discs.

Total floor area is now 200,000 sq ft and employment is approximately 350. The company's technical staff, particularly those concerned with foundry work, is still increasing. The vice-president and general manager is J. A. Wellings.

THE BRISTOL AEROPLANE COMPANY OF CANADA (1956), LTD., AND ASSOCIATED COMPANIES

WITH no outstanding new development to report during the last twelve months, the Canadian Bristol Companies' effort has been a consolidation of past years' planning. The following are the companies involved:—

The Bristol Aeroplane Company of Canada (1956), Ltd., *200 International Aviation Building, Montreal 3,* is the parent company of the Canadian group. It is the wholly-owned subsidiary of the English Bristol company and it took over the assets and functions of its predecessor, the Bristol Aeroplane Company of Canada, Ltd., in 1956. The Canadian company now controls four operating subsidiaries with headquarters in Montreal, Vancouver, Winnipeg and Mexico City.

Under its president, R. J. Reynolds, the company functions as the directive force behind the various Canadian enterprises, and is the sales executive branch of Bristol in Canada.

Bristol Aero Engines, Ltd., *10210 Pie IX Boulevard, Montreal North 12,* was formed in 1951 through the acquisition by Bristol of Canadian Wright. Headquarters of the company are in a modern plant, completed in 1953, in the suburb of Montreal North. The plant is equipped with up-to-date facilities for the specialized processes, techniques and testing involved in the overhaul of aircraft engines.

The company handles the overhaul and reconditioning of Wright Turbo-Compound engines for the R.C.A.F. C-119 and Neptune aircraft and T.C.A. Super Constellations. It also performs similar work on the Merlin engines for R.C.A.F. Lancasters, Mustangs and North Star aircraft. The overhaul of the Wright 18-cylinder Turbo-Compound engines represents the company's major undertaking at the present time, with the overhaul of Meteor tank engines for the Canadian Army as an addition to aircraft-engine work. This 120,000 sq ft overhaul and repair plant is under the administration of A.V-M. A. L. James, president and general manager.

Bristol Aero Engines (Western), Ltd., *International Airport, Vancouver, B.C.* At its recently modernized, fully-equipped plant at Vancouver Airport, this company carries out the overhaul of Pratt and Whitney and Wright engines for the R.C.A.F., and for several commercial airlines operating throughout Western Canada. In addition the repair of propellers, carburettors and fuel-injection systems is an important function. It is anticipated that the Vancouver company will play a major part in the repair and overhaul of the Proteus engines of Canadian Pacific Air Lines' new Britannia fleet. This operation will be under the direct supervision of the vice-president and general manager, J. H. Holt.

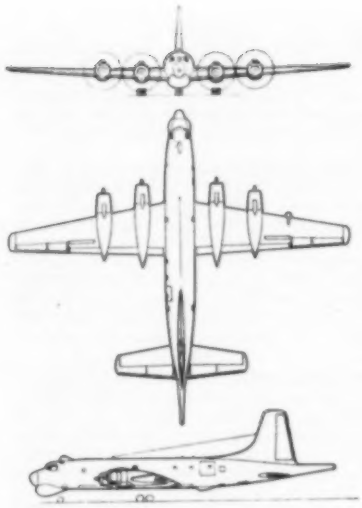
Bristol Aircraft (Western), Ltd., *Stevenson Field, Winnipeg, Manitoba,* started life as MacDonald Brothers Aircraft. The largest of the Bristol interests in North America, and at the present time possessing the group's only airframe plant, the company was formed in 1954. Under the direction of vice-president and former general manager W. S. Haggett the 250,000 sq ft of working space was increased to 350,000 sq ft, a large area of adjacent land was acquired for future expansion, and an ambitious remodelling programme undertaken. This spring a further 75,000 sq ft was added, bringing the total working area to 425,000 sq ft.

The component-manufacturing department was separated from aircraft overhaul and modification, and the stores organization was removed to a new location adjacent to the main building. Among the company's activities are the repair, overhaul and modification of Expeditors, Mitchells and CF-100s of the R.C.A.F.; manufacture of the power egg and other components of the Grumman CS2F of the Royal Canadian Navy; manufacture of floats for various seaplanes and development of prototype floats for amphibious operation; manufacture of turbojet components for Orenda and Avro; and service and repair of the radar and automatic fire-control system for the CF-100.

The Winnipeg plant with its 1,200 employees is under the managership of W. M. Auld.

Bristol De Mexico, S.A. de C.V., *Central Airport, Mexico City,* is the latest development in the Bristol group's long-range plan for the Western hemisphere. The company commenced operations in June as a piston-engine overhaul centre for South America, looking after the interests of operators to and from Mexico. It was designed to facilitate the easy transition from piston to turboprop overhaul when necessary. General manager and vice-president is J. A. Anderson.

Bristol Aircraft (Western) at Winnipeg: the CF-100 conversion programme. Total working area is now 425,000 sq ft.



Canadair CL-28 Argus

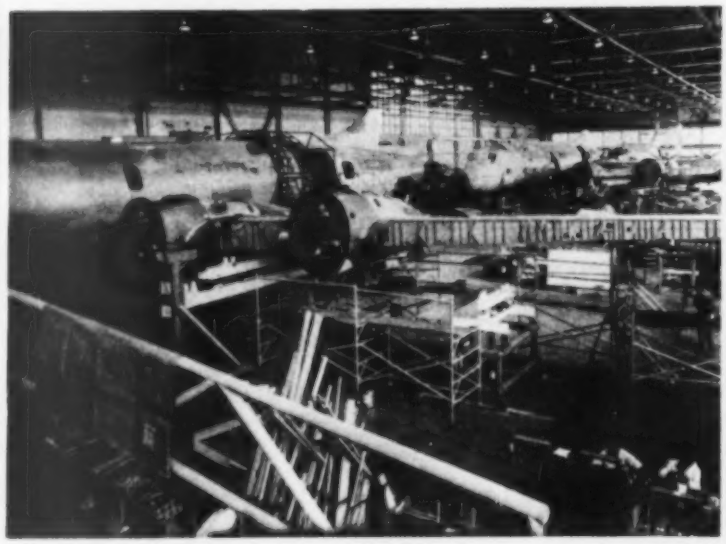
Powerplant	Four Wright Turbo-Compound
Span	142ft
Length	122ft
Gross weight	148,000 lb
Max. speed	350 m.p.h.

Canadair CL-44

Powerplant	Four Bristol Orion
Span	142ft
Length	about 130ft
Gross weight	185,000/200,000 lb
Cruising speed	over 440 m.p.h.

Canadair Sabre 6

Powerplant	Orenda
Span	37ft
Length	37ft
Gross weight	16,000
Max. speed	about 690 m.p.h.



Manufacture of the big CL-28 Argus is on schedule at Canadair's Montreal No. 1 Plant. The fifth, sixth and seventh are here seen on the line last month; the first contract included a total of 25 machines.

The Canadian Industry . . .

CANADAIR, LTD.

P.O. Box 6087, Montreal.

A DIVISION of General Dynamics Corporation of New York, Canadair is one of the two largest single aircraft companies in Canada, with approximately 9,000 employees and a total floor-space of about 3,000,000 sq ft. During the past twelve months production of the Sabre fighter and T-33 jet trainer has continued, and although the rate of delivery is considerably less than it was three years ago, both lines will continue for many months, as described below. Canadair's major aircraft programme concerns the CL-28 Argus, which is now in full production for the R.C.A.F.; the company also hold a firm order from the Canadian government for the CL-44 long-range turboprop transport. These aircraft are all described in more detail below.

In company with other large airframe manufacturers, Canadair are entering other fields in order to increase their annual turnover. When it is fully developed, very large contracts may be placed for the CL-61 Rat, a "snowmobile" with extremely attractive characteristics which has been developed in prototype form for the past eighteen months. The company's Nuclear Division is engaged in several major programmes, including swimming-pool research re actors rated at 1 MW and beta-ray spectrometers. Plant 4 in th corner of the company's airfield at Cartierville, Montreal, has bee extensively altered for missile operations and contains both offic and workshop areas, but no details may be published of its presen activities. Canadair are also making the rear fuselage for the CS2 Tracker under sub-contract to de Havilland of Canada. At the en of the year, when 45 will have been delivered, this work will b passed to Enheat; it is probable, however, that Canadair wi continue to manufacture the CS2F radome. A substantial contrac for tooling—presumably for the F-105 Thunderchief—has bee completed for Republic Aviation, and Canadair were also respon sible for the conversion of a B-47 for use as a test-bed for Orend Engines' Iroquois. Canadair have many projected aircraft design but none are yet in receipt of contracts; even the question of basic jet trainer for the R.C.A.F., for which the company prepare the CL-41 project, has not yet been resolved.

Following the death of John Jay Hopkins, Frank Pace Jr. ha been elected president of General Dynamics and chairman of th board of Canadair; J. Geoffrey Notman remains president o Canadair and senior vice-president of General Dynamics. During the past year a hangar extension has been completed for th accommodation of CL-28s, and ground has been broken for a major addition to the engineering test building. Building 114 has bee selected for the consolidation of all Canadair purchasing and accounting functions, complete with centralized computing facilities.

CL-28. Named Argus and bearing the R.C.A.F. designation CP-107, this aircraft is a long-range maritime-patrol derivative of the Bristol Britannia. It differs from the British aircraft very greatly in that it has a completely new unpressurized fuselage and Wright Turbo-Compound engines for low-altitude economy. The development of this aircraft has been one of the greatest aircraft engineering programmes yet tackled in the Dominion, and it is the largest aeroplane yet put into production anywhere in the British Commonwealth outside the United Kingdom itself. Not surprisingly, Canadair are retaining virtually all the airframe work for themselves.

The first aircraft (there is no prototype) was rolled out last

William Kidd, a Canadair production test pilot, with Sabre No. 1,591— the first of 225 Orenda-Sabre 6s for the West German Air Force.

December exactly on schedule and it flew three days ahead of schedule in March. Phase I testing is now almost complete and static testing has been completed on the second airframe. Four aircraft have now left the end of the line and the third machine, which will be the first to be delivered for operational service, is due to be handed over to the R.C.A.F. in the early autumn of this year.

CL-44 In its essentials the CL-44 is similar to a slightly lengthened Britannia 250 operating at a weight of 185,000 to 200,000 lb, according to sub-type, and powered by four Bristol Orion turboprops. In its first form it will be a military transport, and Canadair have sales rights in Scandinavia, Switzerland and Argentina while the Canadian government can sell such an aeroplane throughout the Americas. Canadair can sell CL-44 freighters throughout the world except in the United Kingdom, but the passenger CL-44 may be sold only in Canada, with a conditional agreement covering the U.S.A., Scandinavia and Switzerland. At present eight are on order for the R.C.A.F., in which service the designation is CC-106. Development is proceeding on schedule and the first aircraft is due for delivery late in 1959.

Sabre More than 1,600 Sabres have passed through the doors of Canadair's Plant 2. Approximately half of these have been powered by the General Electric J47 engine, and these aircraft, virtually identical to the U.S.A.F. F-86E, are now in service with the U.S. Air Force, Venezuela and many NATO countries. For well over three years production has been concentrated upon more powerful versions fitted with the Orenda engine and incorporating numerous detail improvements.

Production of these marks has been concentrated upon the Sabre 5 and 6; 34 Mk 5s are in service with the South African Air Force and a smaller number with the air force of Colombia. R.C.A.F. contracts were completed in June of this year and all the Sabre 6s now being built are for the air force of Western Germany. The latter contract involves the supply of 225 new aircraft and is exceedingly valuable at the present time. The first batch will be handed over to the Luftwaffe by October, 75 will have been delivered by the end of the year and the contract should be complete by the end of 1958, the bulk of the order being manufactured at a peak rate of one aircraft per day. The Luftwaffe is already operating 75 Sabre 5s, which were assigned direct by the Canadian government. Plant 2 is also responsible for a CARE programme on R.C.A.F. Sabres based in Eastern Canada.

T-33 Known to the R.C.A.F. as the Silver Star, and differing from the original Lockheed design in having a Rolls-Royce Nene engine, the Canadair T-33A-N is the standard R.C.A.F. advanced trainer. More than 600 have been delivered from Canadair's Plant 2 and stretched-out production to meet the needs of service attrition will extend to the end of 1958. In addition a CARE programme has been in hand for almost two years, and since the T-33s are widely used by reserve squadrons the latter work should continue for a substantial period.

CANADIAN PRATT AND WHITNEY AIRCRAFT COMPANY, LTD.

Longueil, Montreal 23.

AS the sole representative of the United Aircraft Corporation in Canada, this company licence-produces, sells and services products designed by the associated companies of Pratt and Whitney Aircraft, Hamilton Standard and Sikorsky Aircraft. Incorporated as early as 1928, Canadian Pratt and Whitney employed 350 on a floor-space of 70,000 sq ft in 1952, when a major expansion programme was initiated.

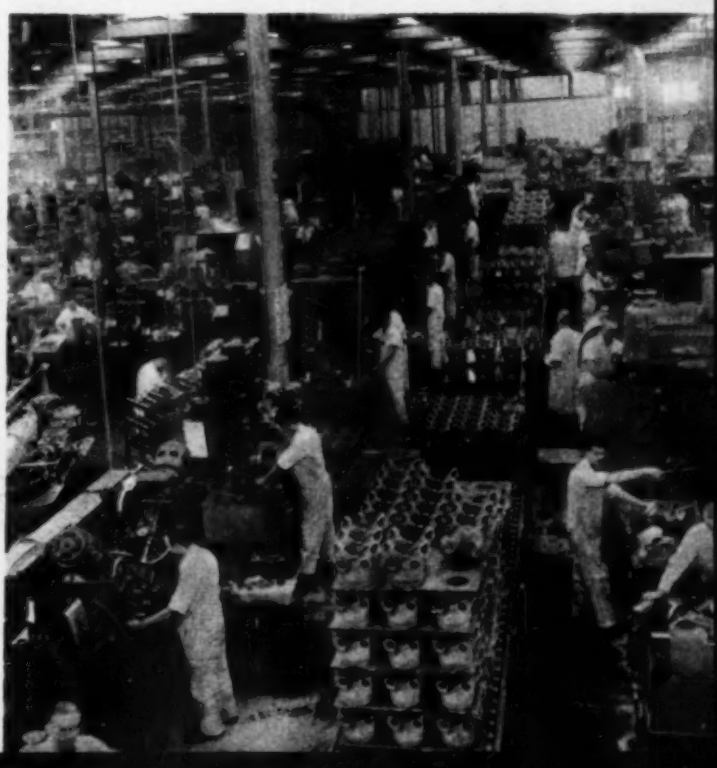
This programme was triggered by the establishment of the company as the sole source of new R-1340 Wasp engines, and a considerable number have since been manufactured using government tools. In September 1955 the company purchased all these tools from the Crown and allocated approximately $5m for the purchase of additional machinery and equipment together with a 94,900 sq ft addition to its plant at Jacques Cartier on the south bank of the St. Lawrence. Also covered by this expenditure was an enlargement of the company's helicopter facility to six times its previous size and relocation of their heliport, the first to be licensed in an urban area in Canada. A design and development group to work in the fields of powerplants, accessories and helicopters was also established. During 1955 Canadian Pratt and Whitney were selected by the Department of Defence Production to build the Wright R-1820 engines for the CS2F Tracker. The company supplied all the tools for this programme and will deliver approximately $19m-worth of R-1820s over a four-year period.

By far the major part of the company's operations consists of the manufacture of spares for such widely used Pratt and Whitney engines as the R-985, R-1340, R-1830 and R-2000. Sales of these engine-parts are world-wide and are expected to remain fairly steady for many years.

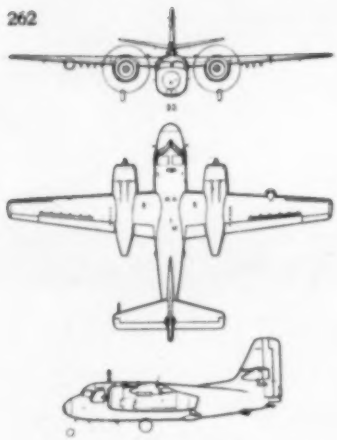
Last April a very considerable further expansion occurred when the company took over the entire plant facilities of Sorel Industries in suburban Longueuil. A property which is being acquired on a rental basis from the Crown, it comprises two major plants and three ancillary buildings totalling 391,279 sq ft (the older of the two main buildings was built by Sir W. G. Armstrong Whitworth and Company before World War 1 for the production of special tool steels and small tools). The company have now completed their expansion but are still engaged in reorganizing their departments to fit them for changing markets.

The main factory (the Jacques Cartier plant) is thus engaged in the manufacture of new R-1820s and the overhaul of R-985s and R-1340s for the Beaver and Otter, and will shortly deliver overhauled R-2000s for the Caribou; 85 per cent of the output comprises spare parts and more than 60 per cent is exported. The plant includes four test cells and new fuel storage is at present being installed. Plant 2 (illustrated in our 1956 Commonwealth issue) is devoted to the manufacture and overhaul of propellers of Hamilton Standard design and airframes for all Sikorsky helicopters in Canada as well as the overhaul of Pratt and Whitney engines. Total floor-space is now no less than 829,592 sq ft and employment, currently about 3,100, should rise to more than 3,400 by October.

A Luftwaffe officer inspecting production of Sabre 6s at Montreal, all of which are destined for service with his country. First delivery will be in October and the whole batch of 225 should be in service next year.

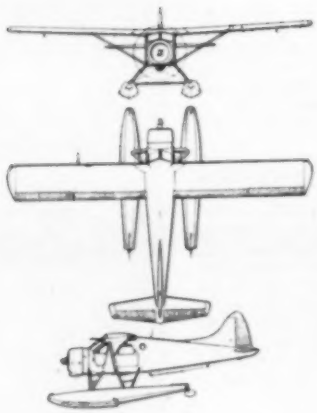


Indicative of the output of engine-spares by Canadian Pratt and Whitney is this line of cylinder heads for R-1340 and R-1830 engines.



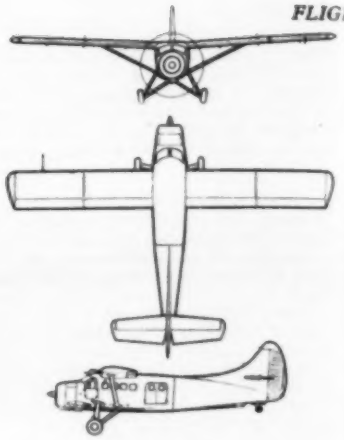
CS2F Tracker

Powerplant	Two Wright R-1820
Span	69ft 8in
Length	42ft 3in
Cruising speed	150 m.p.h.



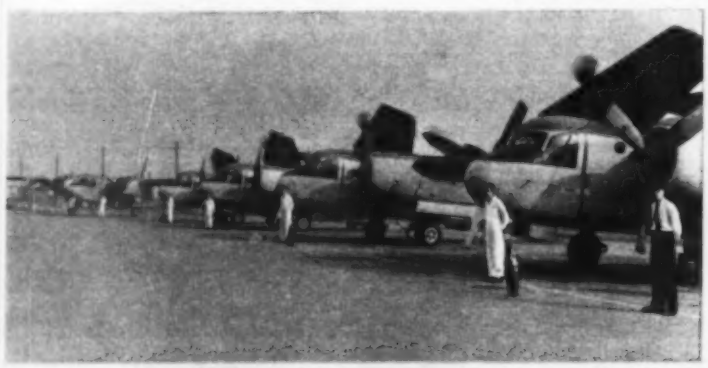
Beaver

Powerplant ...	Pratt and Whitney R-985
Span	48ft
Length	30ft 4in
Gross weight	4,820 lb
Cruising speed (floatplane)	127 m.p.h.



Otter

Powerplant	Pratt and Whitney R-1340
Span	58ft
Length	41ft 10in
Gross weight	7,600 lb
Cruising speed	138 m.p.h.



Ten weeks' output of CS2F-1 Trackers is here lined up for a ceremony outside the de Havilland plant at Downsview, Toronto. Manufacture —under Grumman licence—is widely sub-contracted through the Canadian industry, with de Havilland acting as prime contractor.

THE DE HAVILLAND AIRCRAFT OF CANADA, LTD.

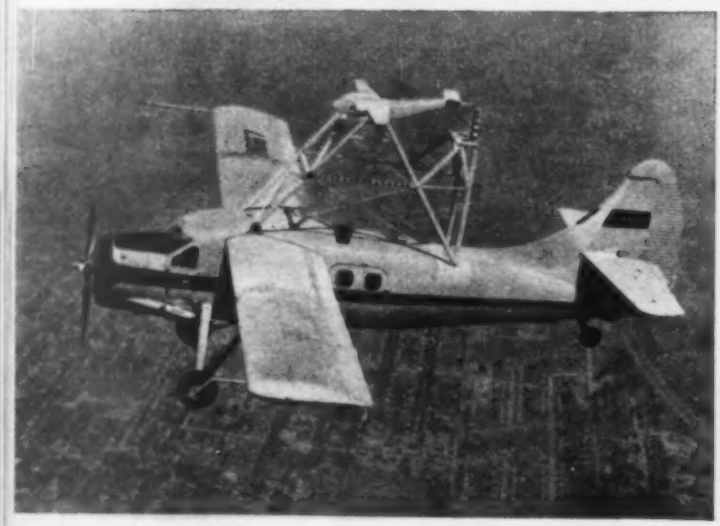
Postal Station L, Toronto.

IT could be argued that de Havilland Aircraft of Canada is at present the most prosperous firm in the Canadian aircraft industry. Steady military income is assured by their substantial contract for the licence-built Grumman CS2F-1 anti-submarine aircraft, and both the Beaver and the Otter continue to sell most successfully in both military and civil fields in all parts of the world. For the future, an exceedingly promising project is gradually entering the "hardware" stage in the form of the company's fourth design, the Caribou. These aircraft are described in more detail later.

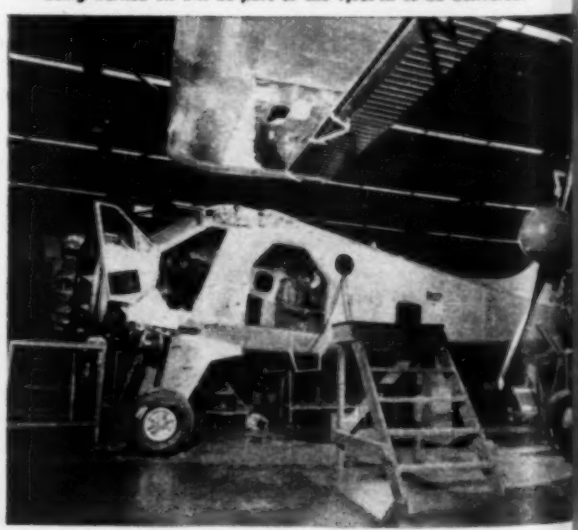
All de Havilland of Canada operations remain concentrated at the company's own airport at Downsview, north of Toronto. On the south side of the airport, Plant I (opened in 1954) contains the company's administrative offices and the main production shops for the Otter and Beaver, and the engineering, research and development departments which are principally engaged in work on the C.4 Caribou. Plant II, on the north side of the field (the original factory), houses the production line for the CS2F as well as the company's Guided Weapon Division (their work may not be described, but is clearly concerned with the Sparrow 2 air-to-air weapon) and an experimental plastics-development department. One-third of Plant II is occupied by the R.C.A.F. as a major supply depot. Close by, Plant III is engaged in the repair and overhaul of engines, principally Gipsies and Orendas.

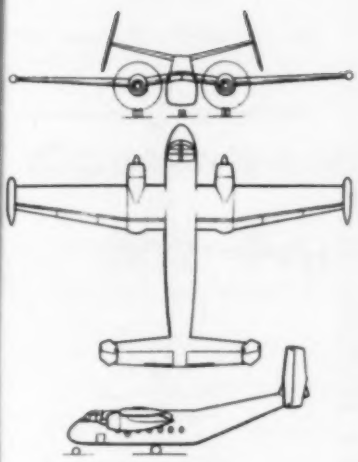
The Canadian Industry . . .

Now familar to Toronto residents, this grotesque device is a D.H.C.3 Otter upon which has been mounted an aerodynamic model of the D.H.C.4 Caribou. A truck-mounted model has also been investigated.



The sturdy and reliable Beaver continues in world demand for a variety of commercial, government and military operators. The fuselage here being worked on will be part of the 1,137th to be delivered.





Caribou

Powerplant ...	Two Pratt and Whitney R-2000
Span	95ft over tip-tank centres
Length	63ft 8in
Gross weight	24,000 lb
Cruising speed	185 m.p.h.

During 1956 de Havilland completely caught up their original production schedule after an unfortunate four-month strike in 1955, and in so doing recorded the most successful year in their history. Highlights of the year were the handing over to the Royal Canadian Navy of the first CS2F-1 on October 12, completion of a new R.C.A.F. contract for 60 D.H.C. 1 Chipmunk trainers in November and the production delivery of the 1,000th Beaver on November 10. The latter machine, incidentally, is an amphibian bearing the registration CF-PCG, the initials of Mr. P. C. Garrett, the vice president and managing director of the company, who commutes in it each day from his home more than 200 miles to the north. Total aircraft output during 1956 included 174 Beavers, 108 Otters and 60 Chipmunks, in addition to an undisclosed but much smaller number of CS2Fs. Total employment is approximately 3,500 and over 1,000,000 sq ft of plant-area are in operation: 716,249 sq ft at Plant I with an additional third floor of 50,000 sq ft, and 307,983 sq ft in Plant II.

CS2F-1 Tracker Chosen as the standard anti-submarine aeroplane of the Royal Canadian Navy, for operation both from shore bases and from H.M.C.S. *Bonaventure*, the Tracker is almost identical to the U.S. Navy machine designed and manufactured by Grumman. Orders at present total 100 at a rate of two per month, and production is widely sub-contracted. De Havilland is the prime contractor responsible for engineering and scheduling of the whole programme, together with manufacture of the forward fuselage and flight deck as well as the assembly of the complete aircraft, the wiring, installation of all equipment and final delivery to R.C.N. acceptance.

The extent of sub-contracting is indicated by the following major breakdown: Canadian Car, wings, nacelles and main-undercarriage doors; Dowty, nose undercarriage; Enheat, rear fuselage and tail; Canadair, radome (plus the first 45 rear fuselages); Jarry, main undercarriage; Fleet, bomb doors, nose-undercarriage doors and centre-section roof to the weapons bay; Bristol, cowlings and nacelles. The Wright R-1820 Cyclone engines are manufactured by Canadian Pratt and Whitney. The CS2F is at least 98-per-cent Canadian manufactured, and—depending on the operational standard of equipment—is delivered for approximately $800,000.

D.H.C.2 Beaver Total production of this famous aircraft is now more than 1,100. The majority are L-20s of the U.S. Army, but a substantial proportion are serving a great variety of minor air forces and commercial or government operators in all parts of the globe. According to customer requirements the Beavers can be delivered either with an arbitrary second-hand engine or with a completely re-built engine delivered by Canadian Pratt and Whitney or the Airwork Corporation (the difference in price is substantial). The aircraft is available with any type of undercarriage configuration for operation from water, snow, or hard surfaces.

D.H.C.3 Otter A surprisingly large and capable aircraft, able to lift 14 passengers or more than a ton of cargo, the Beaver has high-lift, double-slotted flaps and can operate from 600-ft strips; like the Beaver it is available with a variety of undercarriage configurations. Total production is now well in excess of 200 aircraft, rather more than half being military.

D.H.C.4 Caribou The engineering and production departments at Downsview are working under extremely high pressure in their efforts to fly the first D.H.C.4 by mid-summer next year. First announced in March of this year, the Caribou is a logical extension of the Beaver/Otter family; it is intended as an all-weather utility transport for commercial or combat use under the most arduous conditions.

The usable cabin is 23ft in length, 87in high and 83in wide at elbow height, giving a volume of 1,052 cu ft. A very large door is provided at the rear for the loading or air-dropping of heavy stores or vehicles, and the maximum design payload is 7,320 lb, or about 27 passengers. Empty weight will be in the neighbourhood of 14,500 lb. Although turboprops would obviously be applicable, de Havilland have chosen the Pratt and Whitney R-2000 as being particularly suitable at present.

Obviously the C.4 design has been planned in close partnership with the Canadian Department of Defence Production and the Canadian Army. The latter service will in fact receive the first C.4 for evaluation trials on completion of C. of A. tests. Aircraft numbers 3 to 7 inclusive will be supplied to the U.S. Army for a purchase price of approximately $2.5m, the first machine being due for delivery in February 1959.

Fairey Aviation at Eastern Passage, Nova Scotia: line of R.C.N. Banshee aircraft undergoing overhaul and modification.

THE FAIREY AVIATION COMPANY OF CANADA, LTD.

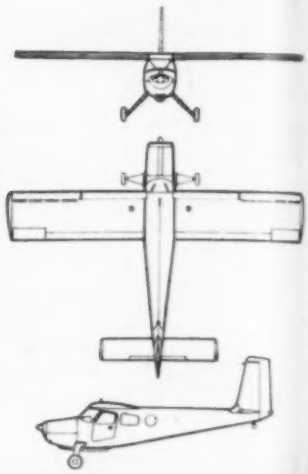
P.O. Box 69, Dartmouth, Nova Scotia.

THE past twelve months have seen a satisfactory consolidation and enlargement of the progress previously reported on the new aircraft types which are being overhauled, serviced and modified by this company, together with an expansion of the plant buildings at Eastern Passage, Nova Scotia. The plant has been mainly concerned with the developing modification programmes—which are becoming more extensive than anticipated—on the R.C.A.F. Lockheed P2V-7 Neptune and the R.C.N. McDonnell F2H-3 Banshee aircraft. Work on the R.C.A.F. Lancaster and the R.C.N. Avenger has reached the stage where it is now being phased-out in favour of work on the newer types. The facilities of the Eastern Passage plant are now being made available to the CS2F Tracker, the latest addition to the anti-submarine equipment of the R.C.N.

Work continues to progress on the design and production of Fairey Hydrobooster units and hydraulic and pneumatic actuators for the Avro CF-100, the Canadair Argus and the Avro Arrow. This work is leading the company into the field of micronic filtration—a recent development of the parent Fairey company. Recent additions to the manufacturing facilities include some of the latest swaging processes, capacity for which is now being offered to Canadian manufacturers.

As most of the aircraft development work on the Canadian East Coast is connected with anti-submarine activities (both for the

The ninth R.C.A.F. Neptune leaving the Fairey plant at Eastern Passage following overhaul and modification. In addition to this main East-coast facility, the company has a branch in British Columbia.



Fleet-manufactured Helio Courier: Powerplant, Lycoming 260 h.p.; span, 39ft; length, 30ft; gross weight, 2,800 lb; cruising speed, 157 m.p.h.

The Canadian Industry . . .

R.C.N. and for the Maritime Air Command of the R.C.A.F.) there is nearly always an electrical aspect to a modification. This, not unnaturally, is leading the company into the fields of testing and calibration of electronic equipment.

Plant expansion is evidenced by the new design office which was opened on May 6, 1957, the opening coinciding with the company's annual general meeting. This office is regarded as having one of the most modern layouts in Eastern Canada. The department contains complete photographic, printing and library facilities. The plant now has over 250,000 sq ft under cover and the personnel figure continues around the 1,000 mark with a weekly payroll of approximately $55,000.

At Patricia Bay, in British Columbia, work has continued on both civil and military aircraft, with the emphasis on civil contracts. A total of 111 aircraft were handled in the past year, of which 98 were civilian.

Future prospects for the company appear excellent. It is expected that, within a year, an overhaul and maintenance programme will be commenced for the Canadair Argus; and it is also hoped that the Fairey Ultra-light helicopter will commence its Canadian sales tour in the near future. If this tour proves successful, there is every possibility that the aircraft will be manufactured by the Canadian company. The company's plans extend also to the new Halifax International Airport, soon to commence operations, at Kelly Lake, near Halifax.

C. E. Hibbert, M.B.E., the managing director, is now a vice-president of the company and, as before, the plant executives are A. Murray Cameron, secretary-treasurer; A. C. Earle, plant manager; E. C. Garrard, chief designer; W. J. May, chief inspector; and D. W. Howell, branch plant manager, West Coast.

FLEET MANUFACTURING, LTD.

P.O. Box 300, Fort Erie, Ontario.

EXTENSIVE sub-contract work for the Canadian aircraft industry is carried out by Fleet at its Fort Erie plant. This has included the production of flaps, ailerons and rocket pods for the CF-100, and of bomb-bay and nose-bay doors and escape hatches for the CS2F. Wheel/ski assemblies for the D.H.C. Beaver; wing extensions for the Mk 5 version of the CF-100; and tooling for the CF-105 details and assemblies, have also formed part of the production programme.

In addition to the CS2F work, mentioned above, for de Havilland, the company has also manufactured Tracker components for Enheat Aircraft and CanCar. For de Havilland Beavers and Otters, honeycomb floors have been produced. The facilities of the plastics department have been expanded over the past two years and, in addition to its aircraft work, the company has extensive non-aviation projects including the production of large radar antennae.

Fleet holds Canadian and Commonwealth manufacturing and sales rights for the Helio Courier, and five Couriers have been manufactured at Fort Erie. President and general manager of Fleet Manufacturing is H. L. Eberts.

Interior of the engine instruction school which Rolls-Royce have provided at the company's Montreal plant for the training of operators.

ROLLS-ROYCE OF CANADA, LTD.

P.O. Box 10, Dorval Station, Quebec.

A WHOLLY owned subsidiary of the parent company of Derby, Rolls-Royce of Canada maintain an extensive aero spares department to provide service-support for all Rolls-Royce engines in North America. Parts are supplied on a carefully calculated "advanced usage" basis which is under continuous review, and all spares in normal usage can be delivered to operators within 30 days. Technical services are provided for the R.C.A.F., R.C.N., T.C.A., the Canadian Department of Transport, Capital Airlines, United States Steel, Standard Oil of California and Cubana. A comprehensive instructional school is operated at Montreal for users' personnel.

For the Canadair T-33 Silver Star, 900 Nene 10 turbojets were delivered of which 50 were manufactured at the Montreal plant. All these engines are overhauled at Montreal (the Nene 10 is now cleared for 1,000 hr but is operated at 900 to suit the airframe inspection cycle), and the production of maintenance and overhaul spares will continue for several years. The Montreal factory is also responsible for the overhaul of the Westinghouse J34 which powers the Banshees of the Royal Canadian Navy. Both the Dart and the Merlin have long been widely used in North American transport operations and plans are in hand for accommodating Dart overhauls at Montreal. This promises to become a major operation for Darts in Viscounts, Fairchild-built Friendships and the many projects of American design which will use this engine. It is also relevant to refer to the selection of the Rolls-Royce Conway as the powerplant of the T.C.A. DC-8. Yet another aspect of the work of the Montreal plant is the provision of service-support for Rolls-Royce and Bentley cars and for the range of Rolls-Royce industrial engines which are becoming increasingly accepted across the Atlantic.

A subsidiary company, Rolls-Royce Inc., has just been registered in the U.S.A. to cater for the increased commitments resulting from the growth of business within the United States. The first part of this new organization, which is planned to go into operation next year, is a head office and a spares and service depot which will be built close to Washington D.C. in Fairfax County, Virginia.

During the past twelve months additional office space has been constructed at the Rolls-Royce of Canada headquarters; together with the extended storage space opened one year earlier, it brings the aggregate floor-area up to 100,000 sq ft. The total number of employees engaged upon aero work has now risen to 650. The general manager of Rolls-Royce of Canada is Mr. R. M. Kendall.

Commonwealth Air Forces

A PICTORIAL REVIEW: VARIED ASPECTS OF SERVICE AVIATION OVERSEAS

(Above) Symbolic of North American defence: CF-100 all-weather fighters of the Royal Canadian Air Force fly over the domes of an R.C.A.F. radar station on one of the country's northern defence chains.

(Left) For maritime patrol: one of the Avro Shackleton M.R. 3s operated by No. 35 Squadron of the South African Air Force. Roundels are now giving way to the "castle" insignia on all S.A.A.F. aircraft.

(Above) One of the Royal Canadian Navy's Bell HTL helicopters. This machine belongs to H.M.C.S. "Labrador," an Arctic patrol ship, and is employed chiefly on ice-reconnaissance operations.

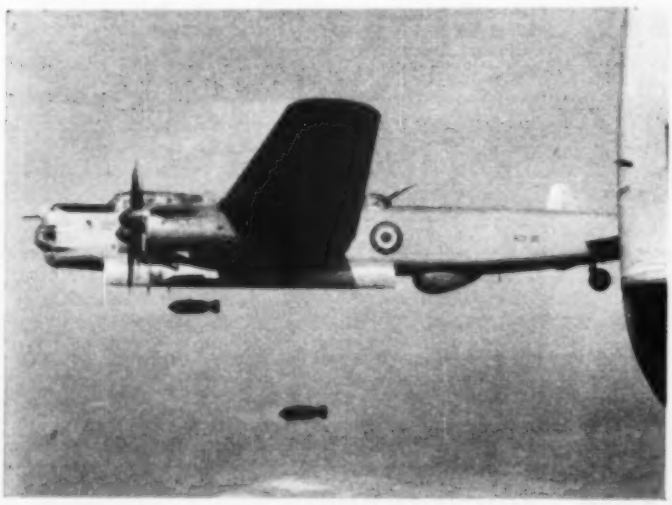
(Left) Australian-built Lincolns are used by No. 1 Squadron of the Royal Australian Air Force in strikes against the terrorist forces in Malaya. They are based at Tengah, on Singapore Island.

(Left) Australian-built Avon Sabres form the equipment of No. 78 (Fighter) Wing of the R.A.A.F. at Williamtown, N.S.W. Two Sabre squadrons are due to operate from Butterworth, Malaya, where Canberras are already based.

Commonwealth Air Forces...

ROYAL AUSTRALIAN AIR FORCE

(Above) Cadets from the R.A.A.F. College at Point Cook, Victoria, practising compass-reading during vacation field exercises in the bush.



An Australian-built Lincoln (above) of No. 1 (Bomber) Squadron pictured during a bombing strike against jungle terrorists in Malaya. The squadron is based at Tengah, and has been engaged in these operations since July, 1950.

(Above) Butterworth, Malaya, is the scene of this view of Lincoln bombing-up. As a base, staging post and diversion, Butterworth plays an important part in the anti-terrorist campaign.

(Left) The new runway at Darwin now being built by No. 5 Airfield Construction Squadron, R.A.A.F. This project was begun in 1955 and should be completed by June of next year.

Canadian Teamwork strengthens N.A.T.O.

Avro CF 100s manned by experienced crews of the R.C.A.F., add essential air strength to N.A.T.O. forces. This teamwork in the air is supported by the experience of Canada's pioneers in aircraft hydraulics and landing gear. For the Avro CF 100 and for Canada's newest and most advanced aircraft projects, Dowty Equipped means first in quality.

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Weight:	400 lbs.
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Process Capacity:	1 to 4 rolls 16 mm, 1 or 2 rolls 35 mm, 1 roll 70 mm — length to 400 ft.
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Commonwealth Air Forces...

ROYAL CANADIAN AIR FORCE

(Above) An R.C.A.F. Silver Star streams a Radop towed target over the R.C.A.F.'s air-to-air firing range near Cold Lake, Alberta. This is used for practice on long-range interceptions by Avro CF-100 squadrons.

(Right) A P2V-7 Neptune of the R.C.A.F. patrols above an R.C.N. submarine off Canada's east coast during a maritime exercise. These Neptunes—latest type of aircraft to go into R.C.A.F. squadron service—carry a ton and a half of electronic detecting equipment for use in their anti-submarine rôle.

(Below, left) A Piasecki H-21A of the R.C.A.F., used chiefly for search and rescue duties and on the Mid-Canada Line. (Below, right) Ever-faithful servant, the Dakota is employed by the R.C.A.F. for transport duties or the training of navigators or wireless operators. When airfield conditions are as wintry as those on the mountains, ski-wheels are used.

(Above) A Canadian-built Grumman CS2F-1 Tracker being ranged for catapulting from H.M.C.S. "Bonaventure," Canada's new aircraft carrier, which early this year joined the R.C.A. Atlantic Command.

Commonwealth Air Forces...

ROYAL CANADIAN NAVY

(Right) What the pilot sees as he comes in to land on the angled deck of H.M.C.S. "Bonaventure," which also has the steam catapult, mirror landing-aid and important Canadian innovations. In addition to the Trackers she embarks ex-U.S. Navy McDonnell F2H-3 Banshees.

ROYAL NEW ZEALAND AIR FORCE

(Left) A Sunderland of No. 5 Maritime Sqn., R.N.Z.A.F., which from Fiji provides search and rescue and joins SEATO exercises. (Below) Venoms of No. 14 Sqn., R.N.Z.A.F., based on Singapore Island, attack terrorist positions with rockets.

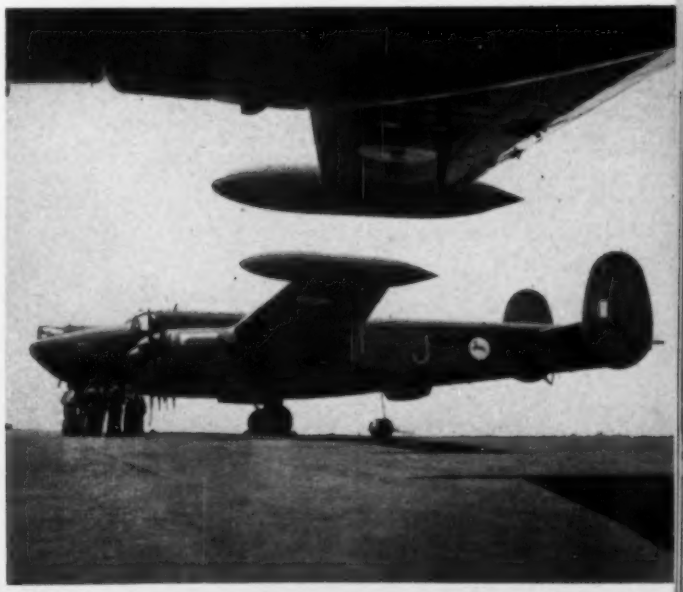
ROYAL RHODESIAN AIR FORCE

(Right) A trio of Vampire T.11 trainers of the R.R.A.F. practising formation over typical Southern Rhodesian farming countryside.

(Below) Putting finishing touches to the R.R.A.F. roundel, the centre of which carries three native assegai. (Below, right) Vampire T.11s of No. 1 Sqn., R.R.A.F. with long-range tanks, taxi in to dispersal at New Salisbury Airport, Southern Rhodesia, on returning from a training sortie.

SOUTH AFRICAN AIR FORCE

(Left) Three Sabres of No. 2 Sqn., S.A.A.F.—known as "The Flying Cheetahs"—in formation near Johannesburg. (Right) Avro Shackleton M. R. 3s to which No. 35 Sqn. have recently transferred their crest and motto—"Shiya Amanzi" (Zulu for "Hit the water", i.e. "Get cracking")—from the Sunderlands which they formerly operated.



The impressive setting of the docks, storage area and smelter of the Aluminium Company of Canada at Kitimat, British Columbia.

The Canadian Industry • Ancillary Companies

Aircraft Industries of Canada, Ltd., *Municipal Airport, St. Johns, Quebec.*

OVERHAUL, modification and conversion work of R.C.A.F. Dakota, PBY and Harvard aircraft, and of various commercial and executive types, is carried out by Aircraft Industries at St. Johns Airport, some thirty miles south-east of Montreal. Total floorspace is now approximately 120,000 sq ft, following the erection of an additional steel-and-concrete hangar.

Aluminium Company of Canada, Ltd., *1,155 Metcalfe Street, Montreal.*

IN a year of "record levels of production, sales and earnings" a net income of over $55¼m in 1956 compared with $48m in 1955 was realized by Aluminium, Ltd., and its subsidiaries, of which the principal fully owned company is the Aluminium Company of Canada (Alcan). Total production of primary aluminium by all subsidiaries and affiliates during last year was 700,000 short tons, of which Canadian smelters produced 620,300 tons.

A total of 121,500 tons of new primary aluminium capacity was added in 1956, consisting of 31,500 tons at Quebec smelters and 90,000 tons at Kitimat, British Columbia, which brought Kitimat's capacity to 180,000 tons per year. Facilities in Jamaica were also enlarged to supply Canadian smelter requirements. As foreseen in last year's annual report, Kitimat, with the increased production facilities now in operation, is beginning to contribute to the company's earnings.

During 1956 a total of $125m was spent on construction of new facilities and it is expected that capital expenditures in 1957 will exceed that amount, as the company still has before it a large expansion programme. In the Saguenay area, work is progressing on the new hydro-electric plant at Chute-des-Passes, which is expected to provide an additional 700,000 h.p. upon completion in 1959. Related smelting facilities in Quebec, with an annual capacity of 120,000 tons, are also being planned, together with new alumina and bauxite developments in Jamaica, British Guiana and French West Africa.

Aviation Electric, Ltd., *P.O. Box 6102, Montreal.*

A CANADIAN affiliate of the Bendix Aviation Corporation and exclusive Canadian distributor for such British concerns as Hymatic Engineering, Lodge Plugs, and Teddington Controls, Aviation Electric has reported a steady expansion in all fields (including sales and service, design engineering, manufacturing and overhaul) during the past year.

The company's achievements have been highlighted by the design, development and manufacture of a ball resolver, torpedo course control and hydraulic valves. The ball resolver is employed in this instance as the brain behind an automatic navigational computer; while the torpedo course control is destined for service with the Royal Canadian Navy. In addition, Aviation Electric now designs and manufactures specialized hydraulic and fuel-flow equipment. The metallurgical and chemical laboratories have been approved by the R.C.A.F. for carrying on a wide range of tests and analysis.

The engineering department has been expanded and additional manufacturing and overhaul facilities have been added. Manufacturing is restricted to precision, close-tolerance work, the bulk of which embodies aircraft instruments, gyros, and similar units. During the past year the company has taken on 100 additional employees, bringing the present total to over 800.

Plans for the coming year include the addition of a 32,000 sq ft, wing to the existing plant. This area will be fully air-conditioned and will house additional manufacturing and test facilities.

Canadian Aero Service, Ltd., *74 Sparks Street, Ottawa.*

THIS company is engaged in engineering studies and geophysical exploration across Canada and in many other areas of the world. The company is associated with Spartan Air Services and has offices in Montreal, Toronto and Calgary in Canada as well as in Paris, Johannesburg and Rio de Janeiro.

Canadian Aero's experience includes more than 1,000,000 miles of airborne geophysical exploration. The company helped in the siting of DEWline radar-stations in northern Canada. It has completed about half a million square miles of planimetric mapping in Western Canada for the oil industry; engineering studies for the location of highways, railroads, pipelines and microwave towers; log-pile inventories; soil studies; city planning and engineering mapping; forestry surveys; and geological studies.

Canadian Aero's prospecting equipment includes the magnetometer, electromagnetometer and scintillation counter, in addition to Wild and Kelsh stereoplotters. Crews from the Ottawa company have completed 35,000 line miles of magnetometer survey in the Northwest Territories in co-operation with Spartan. Canadian Aero's specialists are now planning a rail-line into the bushland of Quebec to reach iron deposits found there by a mining company.

Canadian Aviation Electronics, Ltd., *P.O. Box 915, Station "O," Montreal 9.*

DURING the last twelve months, C.A.E. has celebrated its tenth anniversary. Among this year's achievements have been the delivery of the first and subsequent production models of the CF-100 flight simulator and weapons-system trainer; and the

placing of a contract by Canadian Pacific Air Lines for a DC-6B flight simulator—the first simulator to be ordered by a Canadian airline and the first commercial simulator to be built in Canada.

Congratulating the company on its production of the CF-100 simulator at the official acceptance ceremony of the first machine in February, Air Marshal R. Slemon, Chief of the Canadian Air Staff, disclosed that, excluding development costs, each simulator cost about the same as a CF-100 aircraft. Including the cost of development, the price was increased some 50 per cent.

Soon to be opened at the company's main plant on Cote de Liesse Road, Montreal, is a new computing centre, following the purchase of a PACE analogue computing system. The new installation will be used by the C.A.E. design and development group, mainly in studying flight-simulation, weapons-system simulation, missile and trajectory simulation, radar fire-control and missile components, precision non-linear servo and stability-and-control systems; and will also be available for rental to other companies.

Other important aspects of the company's work during the past year have been an extension of the radar fire-control repair and overhaul programme for the R.C.A.F.; expansion of instrument repair, overhaul and development facilities; extension of radar-warning line maintenance, repair and overhaul programme (by the Western Division of C.A.E. at Winnipeg); development of improved radio-communication system; manufacture of accelerometers and similar components of fire-control and aircraft systems; and the design and manufacture of new industrial instrumentation systems and nucleonic instruments (Western Division, Winnipeg).

President of Canadian Aviation Electronics is K. R. Patrick.

Air Marshal R. Slemon, Rt. Hon. C. D. Howe and K. R. Patrick of C.A.E. view the company's first production CF-100 simulator.

Canadian Marconi Company, *970 McEachran Avenue, Montreal 8.*

THE aviation department of Canadian Marconi was formed in 1952 to provide aeronautical equipment and service to civil airlines, charter and private operators, and those departments of the government and armed forces concerned with aviation. The department's group of development engineers, concerned solely with aviation products, has specialised in designing and producing equipment to the various Canadian and U.S. specifications dealing with form factors, engineering practice, environmental testing, performance characteristics and airworthiness certification. Canadian Marconi claims to be the first electronic company in Canada to have designed and produced an item of civil airborne radio equipment as a private venture.

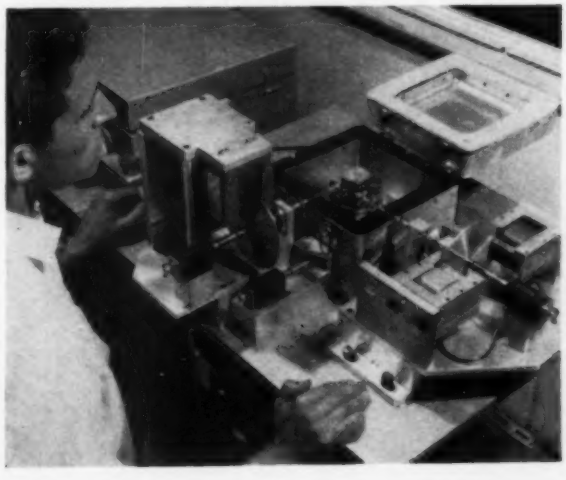
The three major products of the department to date have been the CMA-301 automatic direction-finder; the CMA-402 loudhailer; and the CMA-101/201 HF transmitter-receiver. The ADF was developed to meet the design objectives for such equipment set by Aeronautical Radio, Inc.; the loudhailer employs a fully transistorized amplifier and weighs 55 lb; and the HF set was designed to meet the requirements of the small- and medium-size aircraft used in bush operations.

Nearing the final stages of development is an interesting line of transistorized equipment, notably power supplies for dynamotor replacement and a complete system of aircraft audio control panels, cockpit and cabin loudspeakers, isolation amplifiers and passenger-address power amplifiers. These items give promise of a wide application in aircraft use.

Collins Radio Company of Canada, Ltd., *11 Bermondsey Road, Toronto 16.*

IN its second year of manufacturing in Canada, Collins has continued to consolidate its position. During 1957 production has begun for the R.C.A.F. of the ARC-38 35,000-channel HF transceiver and the ARC-552 1,750-channel UHF transceiver. Export business has increased, and equipment manufactured in the Toronto plant has been shipped to 30 countries in the past year. Executive vice-president is A. V-M. J. L. Plant.

The Aviation Electric ball resolver, recently developed at Montreal, being prepared for testing at sub-zero temperatures.



A photographic mosaic being laid down by technicians of Canadian Aero Service, Ottawa, an associate of Spartan Air Services.

Computing Devices of Canada, Ltd., *P.O. Box 508, Ottawa 4.*

THE Mk 3 version of the C.D.C. Position and Homing Indicator is now in production. This is an automatic dead-reckoning navigation system, designed for single-seat high-speed aircraft, which provides the pilot with a continuous indication of his position relative to his home base or any one of several selected alternates. The system normally operates independently of radio aids, but provision is made to display and use radio-aid data when this is available. The Mk 3 version of the P.H.I. is completely transistorized, weighing less than 25 pounds, and has a power consumption of about 100 watts.

Also in production is the ANTAC system—a long-range navigation system coupled to an integrated tactical display designed by C.D.C. for the Canadair Argus maritime-reconnaissance aircraft. ANTAC is a dead-reckoning system with provision for external references from a variety of electronic radar and radio inputs. A co-ordinated picture of the tactical situation is displayed for the navigator. Steering signals are made available to the auto-pilot either automatically or semi-automatically, and the aircraft's ground position is displayed in latitude and longitude. Some of the equipment associated with the ANTAC system is applicable to the long-range problems of commercial aircraft. The instrument development group at C.D.C. has for some time been carrying out studies concerned with this application of dead-reckoning navigation systems. Consideration has also been given to the terminal-area problem and air traffic control.

The company also has a contract to develop a navigation and interception computer for the Avro Aircraft CF-105. This will be a new system based on an expansion of the principles on

which the P.H.I. is designed, with a high degree of automation.

In October 1956, C.D.C. expanded its service to the Canadian aircraft industry with the installation of a 96-amplifier REAC analogue computer. The components of the computer were chosen to permit missile and aircraft flight studies in three dimensions. Most of the working time on the computer so far has been taken up with classified work for government agencies. The NCR 102D computer in the company's data-processing centre has been supplemented by a Bendix G-15D high-speed, stored-program digital computer.

Cossor (Canada), Ltd., *301-303 Windsor Street, Halifax, Nova Scotia.*

THIS company has continued to expand its activities over the past twelve months and now employs more than 300 staff. The Service and Installation Division, headed by Cdr. J. Percy, has grown in strength and is making active preparations to cope with the electronics equipment in the new Argus, Tracker and Banshee aircraft of the R.C.A.F. and the R.C.N.

The Research and Development Division, under the direction of A. Levin, has increased its strength to more than 50. The work continues to include such different fields as ionospheric sounding, communications equipment, instruments, and a number of defence developments.

The Production Division has had a busy year, its main effort being continued production of the company's V.H.F. ground transmitter which is now standard at all Department of Transport aeronautical ground-stations. It has additionally produced medium-frequency navigational beacons and a portable ionospheric sounder and recorder.

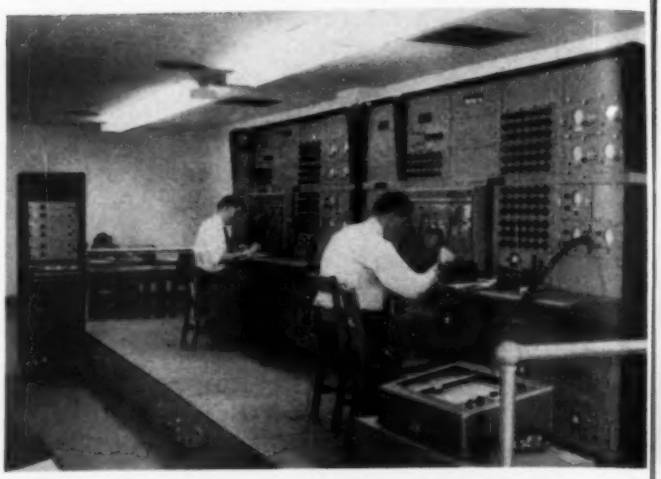
Plans for the present year include a move into a new plant from the temporary quarters which the company has utilized since its inception nine years ago. Managing director is A. C. Carter.

Decca Radar (Canada), Ltd., *23 Six Points Road, Toronto 18.*

DURING the past twelve months this company have continued to expand their activities and widen their fields of application. The Decca medium-range air surveillance radar Type MR.75 has been fitted at Toronto, Montreal, Winnipeg and Vancouver Airports, and the company have also installed Decca meteorological radar Type 41 at Toronto and sold to the Canadian Meteorological Services a wind-finding radar. Plans for the immediate future include the development of an air-traffic-control display system for the Canadian Department of Transport.

The Canadian Decca Navigator company is no longer in existence, the licence for the Decca Navigator system in Canada being held by the Bendix Aviation Corporation and Bendix Eclipse of Canada through their associates, Computing Devices of Canada. These organizations have all been involved in the establishment of the Decca coverage at present existing and in preparation in Canada. The West and East Newfoundland chains are now in operation, the latter incorporating the Dectra pair of stations now under test, and two further chains are under construction in Nova Scotia and Quebec.

Main undercarriage legs for the CF-105 Arrow are produced by Dowty at Ajax.



This REAC analogue computer, containing 96 amplifiers, was recently installed by Computing Devices of Canada at Ottawa.

Dowty Equipment of Canada, Ltd., *Ajax, Ontario.*

ORIGINALLY established in Montreal in 1946, Dowty Canada had as its first major assignment the project design of the undercarriage for the Avro CF-100. Prototype work was done by Dowty Equipment, Ltd., at Cheltenham, and the Dowty gear was fitted to the first CF-100 in 1949. In the same year the company moved to new premises at Ajax and this plant has since delivered more than 600 sets of CF-100 undercarriages, with further deliveries extending well into next year.

By far the largest engineering programme yet handled by the company is the design and manufacture of the main undercarriage for the Avro CF-105 Arrow supersonic fighter. The geometry of this aircraft is such that the main legs are exceedingly lengthy and the weight of the aircraft is so great that, taken in conjunction with the severely limited volume available for the retracted gear, the structure of the legs is in extremely high-strength steel of a character previously quite unknown in Canada. The leg houses a Liquid Spring shock-absorber and has dual wheels arranged in tandem. This very advanced unit has been fully tested on the company's considerably expanded test rigs and is now fully developed.

Dowty are also in production upon nose undercarriages for the CS2F (licence-produced to Bendix design) and manufacture the shock-absorber for the Beaver tailwheel. They are the principal sub-contractor to de Havilland on the C.4 Caribou hydraulic system, and may obtain business with the hydraulics for the CL-44 transport. The company also manufacture, sell and service certain products by Dunlop's Aviation Division (over 4,500 wheels, brakes, valves and Maxaret units have been delivered for CF-100s) and also expect to provide service and spares-backing for undercarriages of Fairchild-built Friendships, and Viscounts and Vanguards of T.C.A. It would be logical for the products of Dowty Fuel Systems to find Canadian applications.

At the company's South Plant at Ajax both main and guillotine drop-test rigs are in full operation, and recent additions include new research equipment for low-temperature hydraulics and metallurgy. The trend, first noticed in 1956, of increased technical staff and fewer on the production floor continues; total personnel have stabilized at the slightly reduced level of 350, but floor-area has remained almost constant at 75,000 sq ft. The president of the company is R. F. Hunt.

Enheat Aircraft (Aircraft Division of Enamel and Heating Products, Ltd.), *Amherst, Nova Scotia.*

AT the present time the Enheat plant, which covers an area of 288,000 sq ft, is engaged in the manufacture of the empennage unit and aft fuselage for the Grumman CS2F Tracker. The empennage contract amounts to 100 units and to date 55 have been released from the jigs and 46 have been delivered to de Havilland Aircraft of Canada, the prime contractor. A total of 57 aft fuselages are being built at the rate of two per month and delivery of the first one will be made about September 1 this year. Deflectors are being built at Enheat for the Wright engines fitted to the CS2F.

Contracts have been awarded to Enheat for the repair and overhaul of components on the following aircraft: Lockheed Neptunes used by the R.C.A.F. Eastern Air Command, McDonnell Banshees of the Royal Canadian Navy, and the Grumman CS2F. Further contracts are anticipated.

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The Napier Gazelle free-turbine engine, airborne for the first time functioned smoothly and contributed a noticeable reduction in helicopter noise levels.

The Wessex, built to lift 2½ tons and designed primarily for anti-submarine operations, is on order for the Royal Navy. It is the first free-turbine helicopter in the world.

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The Canadian Industry . . .

Garrett Manufacturing Corporation of Canada, Ltd., *4 Racine Road, Rexdale, Ontario.*

HEADQUARTERS and plant of this company—a subsidiary of the Garrett Corporation of Los Angeles—are in Rexdale, Toronto. In full operation is a specially equipped electronic laboratory engaged in the repair, overhaul and manufacture of several types of aircraft components. During the past year the test facilities have been expanded to provide for various classes of turbo machinery, including refrigeration turbines, air-turbine starters and auxiliary gas-turbines. The company has a number of contracts with the Canadian government.

Godfrey Engineering Company, Ltd., *480 Metropolitan Boulevard, Lachine, Montreal 32.*

AN affiliate of Sir George Godfrey and Partners, Ltd., of Hanworth, Middlesex, the Canadian Godfrey company continues its work on the manufacture of air-conditioning equipment for aircraft, including cabin superchargers and cold-air units. Ground servicing equipment is also designed and manufactured. North American aircraft utilizing Godfrey equipment include the Viscounts of T.C.A. and of Capital Airlines.

Hunting Associates, Ltd., *1450 O'Connor Drive, Toronto.*

THE five main companies in the Canadian Hunting group have yet another extremely active year to report. During the past twelve months, a new company—Hunting Technical and Exploration Services—has been formed; and P.S.C. Applied Research, Ltd., has passed from Hunting to A. V. Roe Canada ownership.

On the occasion of the sale of P.S.C. Applied Research, Ltd. (designers and manufacturers of electro-mechanical instrument systems, including the R-Theta computer), D. N. Kendall, founder and operating head of the Canadian Hunting companies, said that the group would now expand its main interests—air survey, aircraft operation and overhaul, resources survey and engineering—with an emphasis on geophysics. Brief notes on the various Hunting companies in Canada follow.

Aeromagnetic Surveys, Ltd., *1450 O'Connor Drive, Toronto.*—During the past year, A.S.L. has become a wholly owned subsidiary of Hunting Associates, and for the second time has been awarded a "Blue Ribbon" award by a panel from the U.S.A. for "achievement in equipment development aiding the technological advancement of the mining industry." The equipment so honoured is the helicopter version of the company's electromagnetic detector. A record volume of geophysical work was carried out during 1956, and staff numbers were doubled.

Field Aviation Company, Ltd., *Oshawa Airport, Ontario.*—Primarily concerned with the maintenance, overhaul and special-purpose modification of Kenting's aircraft fleet, Field also performs maintenance work for the R.C.A.F. On the agency sales side, business has continued to expand—particularly in the executive-aircraft sphere—and there are now Field branches at Ottawa, Toronto, Winnipeg and Calgary, in addition to the headquarters at Oshawa. The company has been associated with a North American demonstration tour of the Hunting Percival Jet Provost.

Hunting Technical and Exploration Services, Ltd., *1450 O'Connor Drive, Toronto.*—This company was formed last December to take over the existing engineering services of the resources-survey division of the Photographic Survey Corporation. With a staff of civil engineers, soils engineers, foresters, hydrologists, agriculturalists, geologists, geophysicists and engineers in other fields, H.T.E.S. performs resources surveys and also offers consulting and advisory services relating to natural-resources development and utilization. In July this year, the opening of a branch office in Calgary was announced.

Kenting Aviation, Ltd., *Oshawa Airport, Ontario.*—Operators of the varied P.S.C./A.R.L. fleet of aircraft, Kenting were honoured in April this year by the award of the Johnston Memorial Trophy to two of the company's pilots (and seven aircrew of Hunting Aerosurveys, Ltd.) who had participated in the 1955-56 Antarctic Expedition. One of the company's Cansos has been operating both in Grahamland Peninsula in the Antarctic and in Baffinland, north of the Arctic Circle, during the past twelve months.

The Photographic Survey Corporation, Ltd., *1450 O'Connor Drive, Toronto.*—P.S.C. have been awarded a contract to continue the Canadian government's Shoran-controlled survey of Canada's northlands which was begun in 1947 by the Canadian Geodetic Survey. This operation, now taking place, involves the lattice photographic coverage of some 40,000 square miles of Baffinland. The company's airborne profile recorder is being used, and the aircraft will include a B-17, Canso, DC-4 and DC-3.

Other recent developments have included the joint formation of a new air-survey company, Aeromapas Seravenca, in Caracas, Venezuela; the acquisition of tellurometer electronic distance-measuring equipment; and the formation of an associated company, Photronix, Inc., in the U.S.A.

Jarry Hydraulics, Division of Jarry Automobile, Ltd., *4384 St. Denis, Montreal 18.*

IT is doubtful if any other aircraft company in the world can match Jarry Hydraulics for the sheer intensity of their operations. Their total floor-space devoted to actual production has in the past been only 19,000 sq ft, yet their turnover in the current year should exceed $3½m, and $9m can be seen five years hence. Jarry Hydraulics have been established only six years yet they are in production upon an extraordinary range of major items of equipment for some of the most advanced aircraft in the world.

Among the items designed by Jarry and manufactured solely by them may be counted the complete nose undercarriage for the CF-105 Arrow, together with the powered controls for all three axes, speed-brake jacks, main-undercarriage jacks and up-locks; and for the D.H.C.4 Caribou the company have gained the contract for all units of the undercarriage and other major accessories. For many years substantial production has been maintained upon undercarriages, flap-jacks and brake actuators for the Beaver, Otter, F-86 and T-33. In addition Jarry licence-produce the Bendix main undercarriage for the CS2F Tracker. For the CL-28 Argus, Jarry make the main and nose undercarriage (of basic Messier design, re-engineered by Canadair) together with the steering cylinder, main retraction cylinder, up-lock jacks and the flying-control feel-simulator (by Hobson); in addition each Argus has eight ball-screw flap actuators of Jarry design. Similar business is expected to accrue with regard to the CL-44 transport.

Considerable effort has been applied to the development of high-temperature hydraulics, and these have been employed in the Arrow (owing to the supersonic environment) and also in engine accessories, including nozzle actuators for the reheat Orenda (now in production) and in prototype form for the Iroquois. Jarry also licence-produce large quantities of Bendix wheels and brakes, and they overhaul and repair the undercarriages of T.C.A. North Stars and Super Constellations.

Jarry Automobile, Ltd., entered the aviation business during World War 2, and resumed such operations in 1950 when some 60,000 sq ft on five floors above the company's car showrooms was turned over to the development and manufacture of aeronautical products. An engineering design department was established in 1953, and full environmental-test and other experimental rigs have since been added, which, for an extraordinarily low outlay, have enabled the company to qualify units for the supersonic CF-105. On September 1 Jarry are opening a new facility of 18,000 sq ft equipped with over 50 large machine tools. The new plant, also in north Montreal, will be particularly suited to work on the heavy forgings of the Argus undercarriage and of the even larger gear for the CL-44. The legs of the Caribou are also of considerable size and will necessitate the use of heavy machine tools for their production.

Not unnaturally Jarry Hydraulics have been so successful that they have been approached by "two American firms and one British firm . . . with a view to acquiring financial control." The company have elected to remain completely independent. Total floor-space with the new plant in operation will total some 78,000 sq ft and the payroll will be approximately 250. The company president is Fernand Jarry.

In this Jarry Hydraulics test room are jacks for CL-28 Argus (main undercarriage), Otter, CS2F and Beaver aircraft.

The Canadian Industry . . .

Walter Kidde and Company of Canada, Ltd., *5500 Royalmount Avenue, Montreal 9.*

THIS company was formed in 1928 as a subsidiary of Walter Kidde Inc., of Belleville, New Jersey. The Canadian company's head office and plant at Montreal now consists of 20,000 sq ft. A district branch in Toronto has been operating for over 12 months and it is intended to open a further office in Vancouver and to expand the facilities at Montreal.

Fire-extinguishing systems for aircraft form an important section of the company's products. Kidde's pneumatic equipment includes air compressors, dehydration equipment and pressure reducers, valves and actuators; and a new pneumatic servo-valve has allowed the company to design complete pneumatic systems for aircraft; such a system is now being supplied for the Fairchild F-27 aircraft. A great deal of work is being carried out for guided missiles and the company is at present supplying auxiliary power-units driven by monofuels such as hydrazine, hydrogen peroxide, ethylene oxide and solid propellents.

The production of glass-fibre containers for high-pressure air has led the Kidde companies to develop filament-wound glass-fibre radomes for both manned aircraft and missiles, giving increased strength and improved electrical characteristics.

Walter Kidde and Co. of Canada, Ltd., have R.C.A.F. approval for the repair and overhaul of items manufactured by themselves and their parent company. Irving J. Hammill is managing director and Eric W. Loveland is manager of the aviation division.

Lucas-Rotax, Ltd., *Box 115, Station H, Toronto 13.*

LIKE many other Canadian companies, Lucas-Rotax are handicapped by the tendency of the Department of Defence Production to place accessory contracts with whoever can offer the lowest price, whereas Canadian firms cannot sell in the U.S.A. unless their products are six per cent cheaper than corresponding items from American manufacturers, even after meeting a 15-per-cent duty tariff. In spite of this handicap Lucas-Rotax are beginning to establish business south of the 49th Parallel and are steadily expanding their operations within Canada.

One of the most important current "Lucas" programmes concerns a complete fuel-system for the Orenda Engines' Iroquois, including a dual air-turbine-driven reheat fuel pump of exceedingly high capacity and capable of operation under high ambient temperatures. Reheat controls are also produced for the smaller Orenda engine. Among the "Rotax" products may be mentioned the complete generating system and other items of equipment for the CF-105 Arrow, as well as a variety of hydraulic constant-speed drives (chiefly for missile purposes) and hydraulic and electrical power packs (for similar applications) as well as a range of magnetic-amplifier controls and conventional electric equipment.

At an *ad hoc* Montreal establishment overhaul and repair operations are conducted upon the Orenda, Nene, Dart and J34 fuel systems, together with a wide range of fuel and electrical accessories. A new facility has been completed at Vancouver International Airport which will serve as a second overhaul and repair establishment principally responsible for the fuel and electrical systems of the C.P.A. Britannia 314s.

The main plant is to the east of Toronto at Scarborough, and forms a self-contained design and production facility. Last winter a new engineering development building, costing over a million dollars and with a floor area of 25,000 sq ft, was put into operation to house the electrical laboratories and fuel-systems research and development staffs. For the Iroquois turbopump rig compressed air is provided by an English Electric Co. of Canada 1,250 h.p. synchronous motor driving a positive-displacement compressor set. Total employment by Lucas-Rotax is approximately 1,200 and the engineering staff has now reached a total of 140. The company's general manager is R. C. Padget.

Martin-Baker Aircraft Company, Ltd., *Collingwood, Ontario.*

FORMED last year, the Canadian branch of the Martin-Baker company of Denham, Bucks, now employs approximately 80 people. They are occupied in the manufacture of Mk 2E ejector seats for the CF-100 and in repair and modification work on this equipment. In the near future the company's 80 ft/sec gun will be fitted to the CF-100 installations in place of the existing units of 60 ft/sec. General manager of the Canadian branch of the company is B. A. Holt.

Noorduyn Norseman Aircraft, Ltd., *P.O. Box 5, St. Laurent, Quebec.*

A MOVE to new premises at Cartierville Airport, near Montreal, is reported by this company, whose sales of Norseman spare parts and volume of overhaul work have steadily increased over the past two years. The new plant, adjoining that of Canadair, will have a total floor area of 40,000 sq ft, plus room for expansion. The building area is being divided into offices, stores, manufacturing and hangar space for the overhaul of Norseman and other aircraft. President of the company is R. B. C. Noorduyn.

Normalair (Canada), Ltd., *P.O. Box 9, Station N, Toronto 14.*

RECENT developments at the Canadian Normalair company include the installation of the company's equipment in the Avro Aircraft CF-105 Arrow; and the manufacture—in addition to overhaul and service—of Normalair units in the plant at Etobicoke, on the outskirts of Toronto.

The company, headed by Mr. P. C. Browne, manager, is looking forward to the advent in Canada of further Viscounts, Vanguards and Britannias, and the return of Comets, all of which are fitted with Normalair equipment.

Northwest Industries, Ltd., *P.O. Box 517, Edmonton, Alberta.*

LOCATED on Edmonton's Municipal Airport, Northwest Industries has approximately 900 employees engaged in the various phases of its operations—an increase of 100 over last year's figure. The current trend, as expressed recently by B. W. Pitfield, vice-president and general manager, is for an increasing emphasis to be placed on the company's capabilities in the electronic field.

The instrument and electronics department, destroyed by fire in 1956, has now been re-established in a new laboratory of steel-and-brick construction. This building, temperature- and humidity-controlled, is fully equipped with modern repair and testing facilities, including those for environmental testing. A completely equipped dial-studio for the preparation and luminizing of instrument dials and related components is included.

Over 100 specialists, who come from many parts of North America and Europe, are engaged in the work of the instrument and electronics laboratory, where the emphasis is on quality of workmanship rather than mass-production. The company's instrument-repair facilities have been approved since 1952 by the Department of Transport, and resident R.C.A.F. quality-control inspectors are responsible for the company's programme of military work.

Greatest volume of output is that of the military aircraft department, which overhauls, repairs and converts Packets, Harvards, Canadair-built T-33s and miscellaneous aircraft components for the R.C.A.F. The commercial-aircraft service department, equipped to handle most types of civil aircraft, has developed into an important part of the company's operations. Among Northwest's customers are C.P.A.L., Imperial Oil, Royal Canadian Mounted Police, Interprovincial Pipe Line Co., Wardair, Pacific Western Airlines, Gunnar Nesbitt Aviation and California Standard Oil Co., and repairs, conversions and installations have been completed on C-46s, DC-4s, DC-3s, Lodestars, Beechcrafts, Bristol Freighters, Doves, Beavers and Otters.

The engineering department is busily engaged in developing and perfecting modifications and improvements to aircraft; design studies; and new developments. The publications section of this department, staffed largely by trained people from Great Britain, is actively engaged in the preparation of engineering orders on the Fairchild C-119 Packet for the R.C.A.F.

Phoenix Engineered Products, Ltd., *750 Laurence Avenue West, Toronto 10.*

THIS company, which employs some 300 people, carries out the repair and overhaul of aircraft instruments for the R.C.A.F. and R.C.N., in addition to the manufacture and development of aircraft instruments and fuel booster-pumps.

Prenco Progress and Engineering Corporation, Ltd., *72-74, Stafford Street, Toronto.*

OCCUPYING approximately 72,000 sq ft of machine-shop area (plus warehouse space) in Toronto, the Prenco company has

The Lucas-Rotax plant at Scarborough, showing new laboratory, completed last winter, behind main block.

New instrument and electronic laboratory of Northwest Industries, Ltd., whose plant is located on Edmonton.

The home of Sperry Gyroscope Company of Canada, on Côte de Liesse Road, Montreal. Diversity of production is here the keynote.

continued to design and produce hydraulic controls and ground equipment for the R.C.A.F. and for Canadian civil operators. A new development is an additional 40,000 sq ft factory at Uxbridge, Ontario.

Pye Canada, Ltd., *82 Northline Road, Toronto 16.*

ALL products of the Pye Group with market applications in the Dominion are currently merchandized by Pye Canada. The company comprises five divisions, concerned respectively with radio-communications; broadcasting, underwater and industrial television; telephone apparatus; scientific instruments; and domestic high-fidelity equipment and portable radios. Branch offices are located in Halifax, Montreal and Vancouver. Pye airborne equipment is at present being used by Canadian Aero Service, Spartan Air Services and Kenting Aviation.

Servomechanisms (Canada), Ltd., *Rexdale Boulevard and Kipling Avenue, Toronto 15.*

THIS company has recently attained a major position in the field of aircraft instrumentation and automatic-control equipment. It has assumed the business in Canada formerly carried on under the name of Industrial Electronics of Canada, Ltd., and has also become the exclusive channel for world-wide distribution of the products and services of Servomechanisms Inc. of New York and Los Angeles, of which the Canadian organization is an integral part.

The company is now located in new quarters near Malton Airport. The plant is fully staffed and equipped to manufacture the complete Servomechanisms range of air-data and related computers and display equipment. It also distributes the lines of servo and hysteresis-synchronous motors, magnetic devices and vacuum-film products made by the components group of the U.S. company. The Canadian company's own engineering staff handle requirements arising in world markets for both new equipment and for adaptations of the products of the American organization.

The Canadian company is currently operating at approximately double the level of last year's activity, and present contracts call for a further doubling of business in 1958. Present production includes fire-control computers and control units for Canadian military aircraft for both domestic and export markets, as well as specialized components and test equipment being shipped directly to overseas customers. The company is now actively engaged in developing applications of its proven techniques for civil aircraft and in scientific fields associated with aircraft.

The president of the company is C. H. Hartley.

Simmonds Aerocessories of Canada, Ltd., *5800 Monkland Avenue, Montreal 28.*

THE Canadian licensee of Simmonds Aerocessories, Inc., of the U.S.A., this company has continued to work on the development and manufacture of a wide range of aircraft accessory equipment, including liquid gauging, latches, controls and special fasteners. The company also represents Hi-Shear, Saunders Valve, King Aircraft Corporation and other companies.

Spartan Air Services, Ltd., *74 Sparks Street, Ottawa 4.*

ESTABLISHED only ten years ago, Spartan is today one of the fastest-growing companies in Canadian aviation, and operates the largest air-survey fleet—using 70 helicopters and fixed-wing aircraft. This year, Spartan has scheduled or in progress some 32 geophysical exploration surveys for governments, mining firms and oil-exploration companies in Canada, Mexico, Columbia, India, Malaya, Indonesia and Kenya. The company has photographed from the air some 1,500,000 square miles of northern Canada for the Canadian government for the production of topographic maps, and is working on one of the largest electromagnetic surveys yet undertaken anywhere. This covers 7,000 square miles of uncharted land in the Canadian sub-Arctic, and is being carried out for over 30 Canadian and U.S. mining companies in a search for nickel/copper deposits.

Spartan's aircraft fleet includes Lancasters, Mosquitos, Ansons, Cessna 310s, Cansos, DC-3s, and Bell, Sikorsky and Vertol helicopters. Nine Vertol H-21B helicopters were recently taken over from the R.C.A.F. and will be used on Mid-Canada radar line re-supply and transport duties. The company, which pioneered high-level (30-35,000ft) commercial photography with fixed-wing aircraft, is the first commercial operator in the world to use the H-21B helicopter.

New data-gathering instruments and new techniques have been employed by Spartan in order to carry out reconnaissance and detailed natural-resources surveys faster and more cheaply than by conventional methods.

Spartan has headquarters in Ottawa and branch offices in Toronto, Montreal, Calgary, Edmonton and the U.K. The company also owns Aerophysics of Canada and Harward, Maclachlan and Company of Kenya, and has a minority interest in Transair, a Canadian airline, and Canadian Aero Service, Ltd.

Sperry Gyroscope Co. of Canada, Ltd., *P.O. Box 710, Montreal.*

REFLECTING a trend common to both the Canadian and British industries, Sperry's manufacturing operations have been slightly decelerated during the past year but are becoming increasingly diverse in character. Typical of present contracts is that which requires an altimeter and an airspeed indicator (of Kollsman design) for two CS2Fs per month—a far cry from 1955 when Canadair alone were fitting the company's instruments to 25 T-33s and 30 F-86s per month. To offset such trends Sperry have developed a pressure transducer, originally designed for use in an altimeter, into a form suitable for papermaking machinery; by the same token, aircraft servo-controls are being used for the automatic control of machine-tools. It is also pertinent to point out that, like all Canadian accessory companies, they have to compete directly with American firms for Canadian business, yet a 15-per-cent tariff effectively handicaps sales of Canadian products in the U.S.A.

Sperry's Canadian company is in production upon a wide variety of aircraft instrumentation, including the well-known Gyrosyn systems and such equipment as amplifiers, synchros and servo motors. In addition, a considerable proportion of the manufacturing facilities is at present devoted to production of A-4 gun/bomb/rocket sights for the 225 Sabre 6s for the Luftwaffe. The company are also, of course, concerned in the provision of service-support for products of the U.S. parent company in use in Canada, including Zero Readers, A-12 autopilots, engine analyzers and the new SP-30 flight system for the T.C.A. DC-8s.

Great emphasis is being placed on the company's Development Engineering Department, which has a technical strength of 100. A major accomplishment of D.E.D. is the LDG-1 low-drift gyro, which has a random drift under ± 1 deg/hr when operating as a free gyro. Owing to its great value in the Arctic (where magnetic references are unobtainable) the LDG-1 is already the subject of an initial order by the R.C.A.F. At present undergoing final flight testing, a servo-diaphragm altimeter is claimed to provide more sensitive and accurate height information than is currently available; other devices under development include an engine synchronizer for turbojet aircraft and a computer which corrects for gyro-compass gimbal errors resulting from roll and pitch.

Floorspace in the company's modern factory on Côte de Liesse Road, Montreal, totals 90,000 sq ft and employment is approximately 600; the managing director is B. W. King.

Standard Aero Engine, Ltd., *P.O. Box 764, Winnipeg.*

STEVENSON FIELD, Winnipeg's main airport, is the home of Standard Aero Engine, who are responsible for the repair and overhaul of a range of some 20 types of piston engine. In addition the company acts as sales representative for several U.S. engine manufacturers, and a second main division of the company is devoted to aircraft and engine accessories. Over 400 different types of accessories are handled, including starters, generators, ignition coils, control boxes and hydraulic and pneumatic equipment. Comprehensive test-rigs are utilized.

The Australian Industry

A SUB-TITLE to this article could well be "An Industry Marks Time," for the tailing-off of aircraft orders has not yet been followed by concrete plans for the future. It is difficult to be specific on the subject of Australia's aircraft industry, apart from quoting the government-declared policy decision that aircraft manufacture will be continued. As indicated in this report from Australia, the size and shape of the industry structure after 1957-58 have not yet been determined. These are certainly matters of major concern for an early decision.

A unique Australian product is the Jindivik target aircraft.

THE last twelve months have indeed constituted a year of problems for the managers of Australia's aircraft factories, and the new financial year has opened with the horizon still clouded. Of the three establishments engaged in the manufacture of aircraft, only one—the works of the Australian de Havilland Company at Sydney—had orders which would sustain a production line for more than two years, even at the most nominal rate of delivery that could be contemplated in times of peace.

De Havilland's 1955 order for a further batch of Vampire Trainers for the Royal Australian Air Force resulted from the survey of jet trainers offering in non-communist countries in 1954/55. No more suitable trainer for R.A.A.F. purposes could be located, but important design-changes included in the specification will give the Vampire Mk 35 a long span of life in the Service. The first of these new trainers will be flying at about the time this survey of the Australian aircraft industry appears in print and the delivery programme is planned to extend over a period of some three years.

The managers of the two Melbourne factories—conducted on adjacent sites at Fishermen's Bend by the Government Aircraft Factories and by the privately-owned Commonwealth Aircraft Corporation respectively—had the same problem on July 1, 1956. That was the knowledge that their major production orders—Canberra bombers and Jindivik aircraft at the Government factories and Avon Sabre fighters, Winjeel trainers and Avon engines at the company-owned factory—were drawing steadily to a close. And no new orders of any consequence could be foreseen to occupy the experienced tradesmen who were progressively becoming surplus.

Reduction of factory work-forces had been planned to take care of the changing situation, including the diversion of effort to an increasing volume of production of maintenance spare-parts. Unfortunately, funds available to the Department of Air under the Budget for the Defence Services for procurement of spares were less than had been expected and spares manufacture also had to be restricted.

The combined effects of these two factors can be seen most clearly from the fall in total employment in the Australian defence aircraft industry from approximately 11,400 in June 1956 to approximately 7,850 in June 1957. Most of the reductions were made between September 1956 and March 1957. At present, total employment in the industry is relatively static.

During this period of adjustment in the aircraft industry, the Commonwealth Government had been deliberating on the shape of things to come in the era of transition from the so-called conventional weapons to the missile age—the same problems that concurrently faced and still face the governments of all countries having other than token defence forces and defence commitments and with an awareness of the costs to the taxpayer in paying for those commitments. Australia's membership of S.E.A.T.O., A.N.Z.U.S. and A.N.Z.A.M. involves the acceptance of joint responsibilities with the other countries concerned in mutual defence matters in the Pacific, and these responsibilities have not been lightly assumed.

The outcome of these deliberations at government level was revealed to the Australian people by the Prime Minister early in April. Significant points from the Prime Minister's statement of policy as they concern the aircraft industry, both in Australia and in the United Kingdom, included the following:—

In the event of war, Australia would, it seemed clear, be fighting side by side with the United States. It had been decided, therefore, in aircraft, artillery and small arms to fit Australia for close co-operation with U.S.A. in the South-East Asian area.

The Fleet Air Arm would continue to consist operationally of one aircraft carrier, one naval air station and a front-line establishment of 40 aircraft in five squadrons. A second carrier would be restored to a flying-training role.

National Service training for the Air Force would end.

In the air, it had been decided to standardize on types of aircraft which would enable the R.A.A.F. to co-operate with American Air Forces with common lines of supply.

It had been decided that an aircraft manufacturing industry should be maintained in Australia.

The first Australian ground-to-air guided-weapons unit would be introduced and would be located in the Sydney defence area.

Subsequently, the Minister for Defence, Sir Philip McBride, led a Defence Mission to the United States of America. He was authorized to consult with the United States Defence leaders regarding the selection of an American fighter aircraft, with the intention that manufacture of the aircraft selected would be undertaken in Australia.

Following his return to Australia, he announced that negotiations were proceeding for the purchase of 12 Lockheed C.130 transports, which would make a major contribution to the strategic and tactical mobility of the Australian defence forces—an important objective of the Government's current Defence policy.

On the subject of fighters, he stated that there was not available in the United States of America at this stage an aircraft which combined the special characteristics of high performance, long range and operational versatility which were essential to meet the R.A.A.F. operational needs. For this reason, it had been decided that the R.A.A.F. would continue to rely on Avon Sabres for its fighter squadrons for the time being.

These developments during the financial year recently ended made it clear to the Australian aircraft industry that it was Government policy for preparedness reasons to maintain facilities for Australian production of aircraft, particularly fighter aircraft, even though new orders were not placed during the year.

The decision not to equip the R.A.A.F. with Lockheed F-104 Starfighter aircraft from the U.S.A. was strongly defended earlier this month by the Australian Minister for Air, Mr. F. M. Osborne, who said that a young country like Australia with special obligations of development and population could not afford all the air defence it needed. Mobility in the Armed Forces and simplicity in weapons were essential, Mr. Osborne emphasized, and it was no good giving in to those armchair critics who demanded "supersonic glamour-fighters" for the R.A.A.F.

Other interesting developments in the Australian aircraft industry during the same period included the ordering by the Royal Swedish Air Board of 12 Jindivik pilotless radio-controlled target aircraft as used at the Woomera rocket range. These aircraft were practically ready for shipment at the close of the financial year and are expected to go into service in Sweden early in 1958.

Produced at the Government Aircraft Factory, Melbourne, and including an Armstrong Siddeley Viper engine and British telemetery, radio control and other equipment, the Jindivik has been an outstanding success at Woomera. The Swedish sale is the first tangible recognition of this success outside the Commonwealth.

Another product of the Government Aircraft Factories, indicative of the continued diversion of some of the factory design-effort to the missiles field, is the Malkara anti-tank guided weapon, the existence of which was disclosed during June 1957. Designed and developed by the Government Aircraft Factories in collaboration with the Weapons Research Establishment at Salisbury, South Australia, Malkara has been proved over many tests to possess great accuracy and can destroy a tank at long distance. Details of the weapon have not been disclosed but a number are being manufactured for Service testing.

The future structure of the Australian aircraft industry cannot be seen clearly at this stage of transition. There will inevitably be some adjustments and rationalization of facilities as the Canberra, Jindivik and Winjeel projects terminate, and some of the plans for additional work for the industry will doubtless prove fruitful.

It is the stated objective of the Government to see that the productive capacity and the tradesmen's skills developed over the years by the aircraft factories will be used in the best interests of the Australian people—for defence purposes to the extent necessary; for the rest, to help speed the industrial development of the Australian nation.

In the field of general aviation unconnected with defence, the year's picture is brighter in that a brand-new agricultural air-

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ICI

MAR 199

craft has made its first appearance. This notable development centred on the first flight of the Kingsford Smith PL-7 Tanker. Powered by a 400 h.p. Armstrong Siddeley Cheetah X engine, the new machine is designed for top-dressing and crop-spraying and features an unusual biplane configuration (see photograph on page 278). The designer of the aircraft is L. Pellarini and it is constructed by Kingsford Smith Aviation Service, Ltd.

Another Pellarini design, the Fawcett 120 light aircraft, is now under consideration as an observation or light-communications machine for the Australian Army. Designed originally as a trainer, the machine first flew in 1954 and has since suffered a number of delays in its certification testing. Interest in the machine revived recently with the carrying-out of flight trials of the type by the Army at Bankstown in May of this year. Civilian development of the 120, a high-wing, tricycle-undercarriage machine powered by a 130 h.p. Gipsy Major, is at present at a standstill pending completion of test-procedure negotiations between the Australian Department of Civil Aviation and the R.A.A.F.

Yet another interesting private venture on the Australian scene is the Molyneux two-seater helicopter, predecessor of the Molyneux XM-1000 five-seat, tandem rotor helicopter powered by a 550 h.p. Pratt and Whitney Wasp engine.

COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.

P.O. Box 779H, Elizabeth Street, Melbourne.

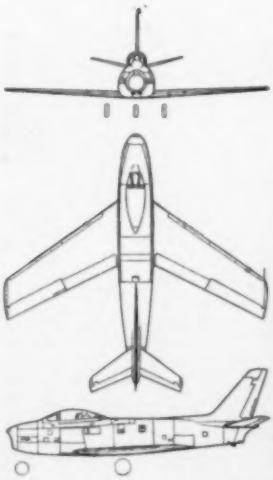
THE first major aircraft manufacturing company to be established in Australia, Commonwealth Aircraft Corporation has its main airframe-producing plant at Fishermen's Bend, outside Melbourne. The company's engine factory is alongside it, and there is a subsidiary (government-owned) engine factory at Lidcombe which C.A.C. operates as a government annexe. The Corporation's activities are under the control of the manager, Sir Lawrence J. Wackett.

As mentioned in the introductory article to this section, Avon-Sabre and Winjeel production is at present tailing off. Sabre production—the contract has been for 90 machines—is by far the most ambitious enterprise yet undertaken by C.A.C. The tapered skins for the wings have been imported, as have about half of the production jigs. Final assembly and test-flying of the Commonwealth-built Sabres has been at the government airfield at Avalon.

The Commonwealth CA-27 Avon Sabre has a performance considerably better than the F-86F on which it is based. The Avon 20 turbojet, also manufactured by C.A.C., gives some 50 per cent more thrust than the American J47. Installation of the Avon farther aft to counteract the engine weight difference resulted in 60 per cent of the Sabre's fuselage being completely re-designed by C.A.C.

The Commonwealth CA-22 Winjeel, forming the basic standard trainer of the R.A.A.F., closely resembles in appearance and in function the Hunting Percival Provost. Standard powerplant for the Winjeel is the 455 h.p. Wasp Junior.

The manufacture of engines as well as aircraft was begun on the formation of the Commonwealth Aircraft Corporation in 1936. The engine division of C.A.C. commenced gas-turbine production with the Rolls-Royce Nene (for Australian-built Vampires), followed by the Avon. For Australian-built Canberras and Sabres, Avon RA.7s have been built, the main components for which have been manufactured by C.A.C.



[CA-27 Avon Sabre

Powerplant	...	C.A.C.-built Avon 20
Span	...	37ft 1in
Length	...	37ft 6in
Gross weight	...	17,000 lb
Max. speed	...	700 m.p.h.

Test cells and fuel-system rigging room of Commonwealth Aircraft Corporation's engine division.

DE HAVILLAND AIRCRAFT PTY., LTD.

P.O. Box 30, Bankstown, N.S.W.

MAJOR activity at the main de Havilland factory at Bankstown is at present concerned with the production of 68 Mk 35 Vampire Trainers for the R.A.A.F., the first of which is almost due for delivery. Approximately 750 men are employed on this project and completion of the order is planned by April 1960. In parallel with the production of Vampire Trainers the company is manufacturing spares and Vampire long-range tanks; while the production of wings and centre-sections for the CA-22 Winjeel has now tailed off.

The service department's work at Bankstown includes the overhaul and repair of Vampires (both fighter and trainer versions) and also the Mk 53 Sea Venoms of the R.A.N.; while the civil side has continued to expand also.

A second factory located at Alexandria, a suburb of Sydney, is the home of the Propeller Division; and guided-missile development is undertaken at another establishment of this division at Salisbury.

GOVERNMENT AIRCRAFT FACTORIES

Department of Defence Production, Lorimer Street, Fishermen's Bend, Melbourne.

DURING the last twelve months the Government Aircraft Factories have continued with the production of Canberra bombers for the R.A.A.F. and Jindivik target aircraft for use at Woomera on joint U.K./Australian projects and for the Royal Swedish Air Board. Servicing, modification and spares programmes for Lincoln, Canberra and Jindivik aircraft were undertaken. Design and development work was carried out on classified projects including the anti-tank guided weapon Malkara. This weapon has had a high degree of success over a period of many tests, and at present a quantity of these weapons is being produced for Service user trials.

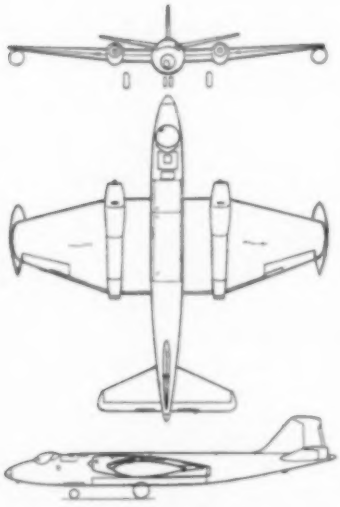
The Government Aircraft Factories form part of the Australian Department of Defence Production, which is directed by the Minister, the Hon. Howard Beale, Q.C., M.P. The officers of the department concerned with higher policy and administration of aircraft production generally are J. L. Knott, O.B.E., Secretary and permanent head; R. H. Doyle, Controller-general of Munitions Supply; N. B. Woodfull, General Manager; and S. C. Westman, Assistant Secretary (Aircraft Production). A separate aircraft maintenance branch is headed by M. A. W. Forestier.

Manager of the Government Aircraft Factories is M. W. Hodgson. The central establishment is at Fishermen's Bend, Melbourne, where administrative, design and planning offices are located, as well as manufacturing and assembly workshops, machine shop, tool room, experimental workshops and laboratories, radio and instrument rooms and central stores. Total floor space is approximately 400,000 sq ft.

Flying operations are now conducted at the Avalon airfield (B. Ralston, acting manager), where final aircraft assembly and aircraft servicing and modification are carried out. Avalon's main runway is 7,000ft in length, with 1,500ft safety over-runs at each end, and the main assembly, servicing and other plant total over 200,000 sq ft. Approximately 1,500 employees are now engaged on aircraft work at Fishermen's Bend and Avalon, compared with 3,000 at this time last year.

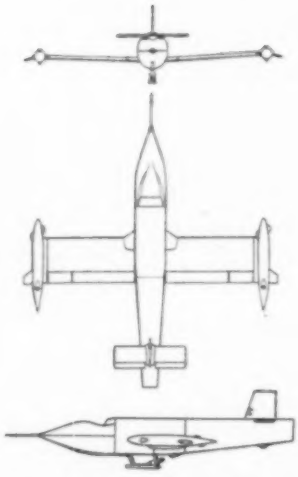
Major sub-contractors to the Government Factories, and their products, include Chrysler Australia, Ltd. (see p. 278); South Australian Railways, Islington, South Australia (wing spars); and New South Wales Railways, Chullora N.S.W. (sundry details and sub-assemblies).

The Australian Industry . . .



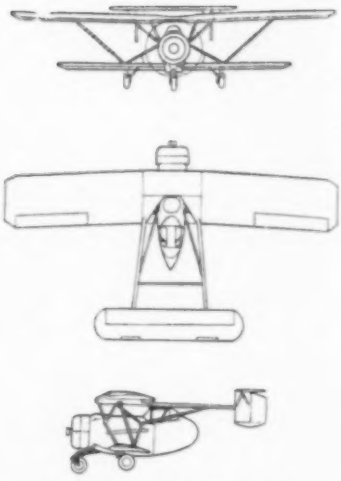
D.A.P. Canberra B20

Powerplant	C.A.C.-built Avon
Span	63ft 11¼in
Length	65ft 6in



D.A.P. Jindivik

Powerplant	A.S. Viper
Span	21ft
Length	23ft 3¾in



Kingsford Smith PL-7 Tanker

Powerplant	A.S. Cheetah X
Span	40 ft 10in
Length	24ft 6in

Chrysler Australia Ltd., *Aircraft Division, Finsbury, South Australia.*

THIS company, located in a suburb of Adelaide, acts as a major sheet-metal sub-contractor and has the main press-shop for the Australian Government Factories.

At present Chrysler Aircraft Division has a production area of 88,000 sq ft. Canberra parts produced have included frames, bulkheads and fuselage assemblies, ribs and details for the wings, tailplane, fin and rudder and also 250-gal wingtip drop-tanks. For Jindivik fuselage and wings, details and sub-assemblies have been manufactured.

The company has also undertaken the manufacture of a varied range of volume-production supplies for the Department of Defence Production, including projectile containers, flares, markers and rocket saddles. Manager of the aircraft division is G. V. Hemer.

KINGSFORD SMITH AVIATION SERVICE PTY., LTD.

P.O. Box 11, Bankstown, New South Wales.

MOST outstanding development in the activities of this company over the past twelve months has been the completion of the prototype PL-7 Tanker agricultural aircraft. This machine was designed and built in only sixteen months, specifically for top-dressing, crop-spraying and other agricultural purposes. Designer of the Tanker is L. Pellarini.

The unorthodox layout of the PL-7, which is powered by an Armstrong Siddeley Cheetah X engine of 400 h.p., is well illustrated in the photograph on this page. The forward section of the fuselage consists of a welded mild-steel tank forming a hopper and carrying all main loads. To the forward face of the tank is attached the engine-mounting frame and nose-wheel boom; the rear face carries the rear-fuselage cone containing cockpit and fuel-tank. The fabric-covered steel-tube tail unit is carried on two tubular steel booms projecting rearwards from the centre-section spar and braced to the tank unit. Simplicity in design has been the aim throughout.

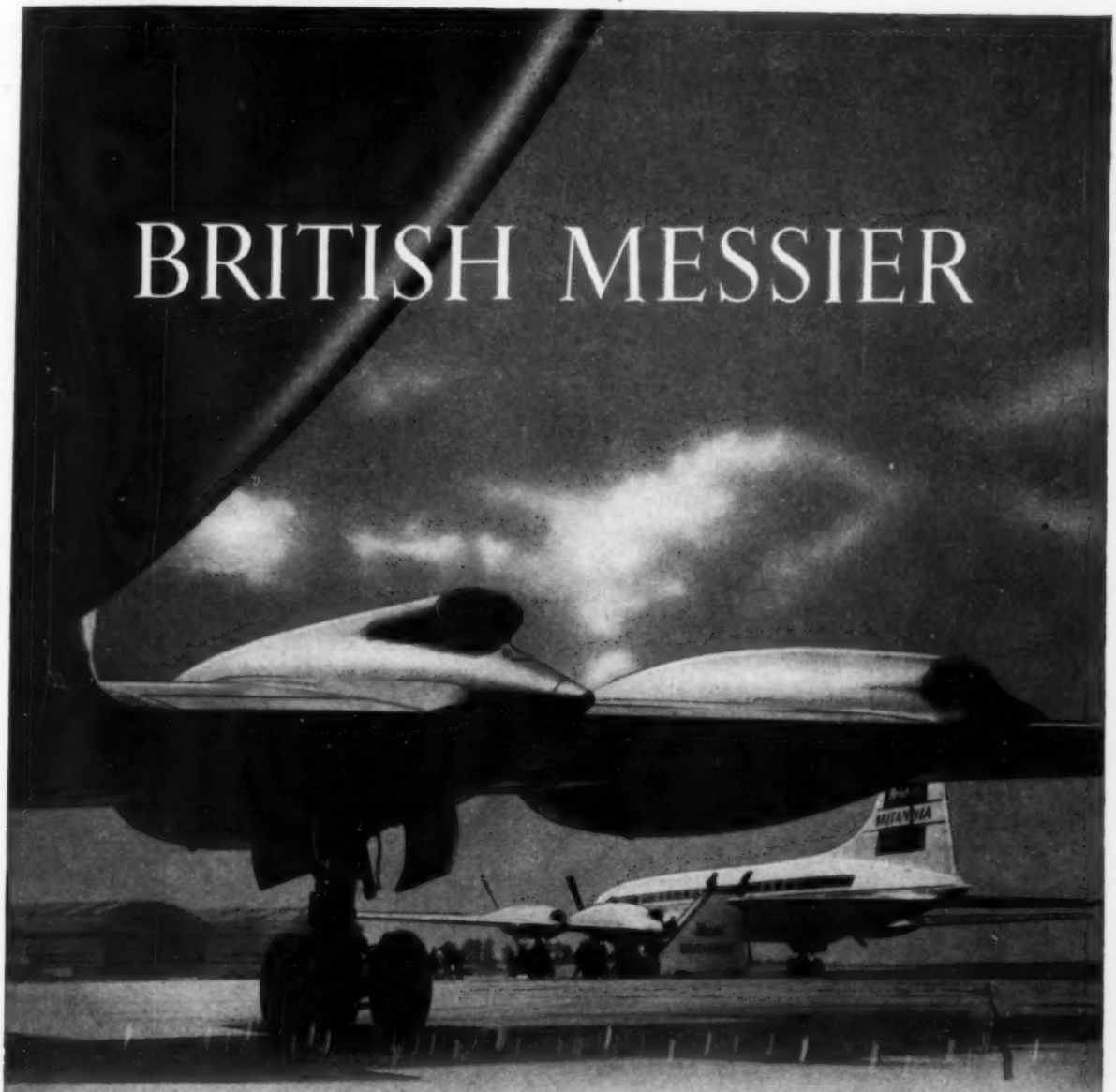
Wheels, tyres and shock-absorber units of the non-retractable tricycle undercarriage are interchangable throughout. Hydraulic brakes are fitted to the mainwheels and are operated by means of toe pedals. The nosewheel is directly steered by means of cables from the rudder pedals. All control cable-runs from cockpit to tail are carried externally along the booms and boom supports.

Dimensions and performance data for the PL-7 include: span 40ft 10in (upper) 30ft (lower); length 24ft 6in; height 12ft; wing area 405 sq ft; gross weight 5,000 lb; cruising speed (75 per cent power) 112 m.p.h.; operating speed (top-dressing and spraying) 70-90 m.p.h.

The company's other activities at Bankstown include the manufacture of aircraft components, the overhaul and repair of aircraft, engines and accessories, and the supply of spare parts, aircraft materials and products of the Auster and Blackburn companies. The expansion of the company's interest in agricultural aircraft has been a notable feature of its development over the past two years.

Managing director and general manager is J. T. Brown.

The Kingsford Smith PL-7 Tanker agricultural aircraft.



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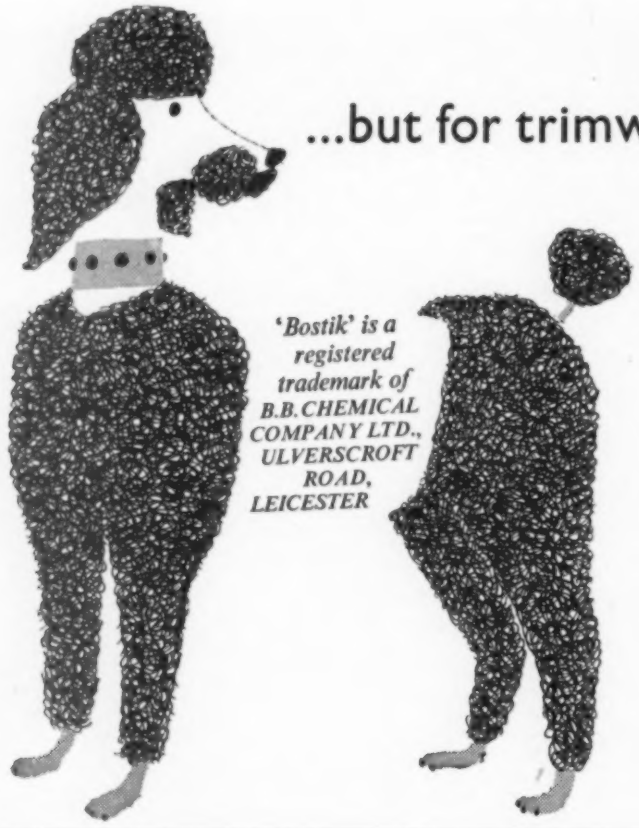

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Joint headquarters of Aeronautical Supply Company, R.F.D. Australia and Cannon Plugs Australia at Essendon.

The Australian Industry • Ancillary Companies

Aeronautical Supply Company Pty., Ltd., *P.O. Box 62, North Essendon, Melbourne.*

THIS company, owned jointly by the Bristol Aeroplane Company (Australia) Pty., Ltd., and Overseas Corporation (Australia), Ltd., has been one of Australia's leading suppliers of aircraft parts and equipment since its formation in 1939. Apart from its interest in general aircraft supplies, the company has concentrated on the marketing in Australia of air-sea-rescue and survival equipment manufactured by the English R.F.D. company, and aircraft electrical connectors made by Cannon Electric of Los Angeles, U.S.A.

In December, 1952, R.F.D. Company (Australia) Pty., Ltd., was formed, owned jointly by R.F.D. and A.S.C. This firm has full design and manufacturing facilities and has developed and produced a number of local items of survival equipment for the Services and civil operators. It has recently been appointed manufacturing licensees of Irving Air Chute of Great Britain, Ltd., and special facilities for parachute manufacture are being erected for this new division. In February, 1955, A.S.C. joined with Cannon in the formation of Cannon Plugs (Australia) Pty., Ltd., a member of the international Cannon group of companies producing electrical connectors. General manager of Aeronautical Supply is C. N. Tomlinson.

Amalgamated Wireless (Australasia), Ltd., *P.O. Box 2516, Sydney.*

FOUNDED in 1913, this company manufactures all types of radio and electronic equipment and is the largest such manufacturer in the Southern Hemisphere. It has designed and produced a wide range of aviation radio equipment, as well as radio and electronic equipment for many other purposes.

Recent products include a complete airborne VOR/ILS system —comprising navigation/communication, glide-slope and marker receivers—which was designed and manufactured in collaboration with Marconi's Wireless Telegraph Company, Ltd. A recent large contract was for the supply of ground aeradio equipment to the Union of South Africa.

A.W.A. is radio-servicing contractor to all Australian airlines, in addition to servicing radio equipment in aircraft of B.O.A.C., K.L.M., P.A.A., C.P.A.L. and T.E.A.L. For this purpose a network of 17 aviation service depots is maintained throughout Australia and New Guinea and at Singapore. The company is also associated closely with the Australian Services in the supply and maintenance of equipment.

Australian Forge and Engineering Pty., Ltd., *14 Parramatta Road, Lidcombe, N.S.W.*

OPERATORS of one of the largest and most versatile forges in the Southern Hemisphere, this company is the leading supplier of aircraft forgings in Australia. They, as well as other contractors to the Government Aircraft Factories, have completed their Avon, Sabre and Canberra programmes, and the only forgings being produced at present are small quantities of spares and replacements for these aircraft and for the Jindivik pilotless aircraft.

The company has produced over 1,500 different types of aircraft forgings, ranging in weight from a few ounces to hundreds of pounds in steel, copper alloys and light alloys, and is well-fitted to meet any future demands made upon it by the Australian aircraft industry.

Bristol Aeroplane Company (Australia) Pty., Ltd., *Short Street, Bankstown, N.S.W.*

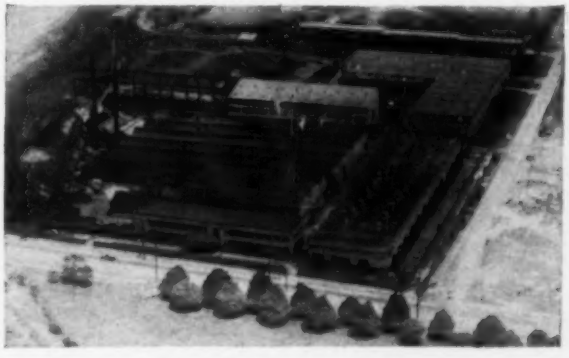
THIS company functions mainly as a sales organization and controlling company for Bristol activities in Australia. Overhaul work is carried out by a subsidiary company, Bristol Aviation Services Pty., Ltd., of Bankstown airport, and this company's programme of work is identical with last year's (Bristol Freighters, Sycamores and DC-3 aircraft; Hercules, Leonides and Pratt and Whitney engines; Rotol gearboxes and engine accessories) except for the fact that new overhaul facilities are being prepared for Bristol Centaurus 661 engines. These engines have arrived in Australia in the Ambassador aircraft which Butler Air Transport have purchased from B.E.A., and an overhaul contract between B.A.T. and Bristol has been initiated.

The company's weapons division at Salisbury and Woomera is operating at an increasing tempo in connection with the further development of the Bloodhound family of guided weapons and other classified G.W. projects. The Bristol Aeroplane Company (Australia) is also a part-owner of the Aeronautical Supply Company Pty., Ltd., of Essendon, Victoria. General manager and director of the two Bristol companies is G/C. E. A. Whiteley, C.B.E., D.F.C.

Dowty Equipment (Australia) Pty., Ltd., *Bankstown, N.S.W.*

SALES and service of undercarriages, fuel systems and hydraulic equipment, and the manufacture and distribution of spare parts, continues to be the function of Dowty Equipment (Australia) which is under the technical control of the parent company at Cheltenham.

Australian Forge and Engineering plant at Lidcombe, Sydney.



The engine-overhaul section of Bristol Aviation Services at Bankstown, N.S.W. Overhaul facilities for Centaurus 661s are being prepared.

The Australian Industry . . .

Dunlop Rubber Australia, Ltd., *Mountain Highway, Bayswater, Victoria.*

DURING the past 12 months synthetic-rubber flexible fuel-tanks have been specially designed by the Australian Dunlop Company for the Vacuum Oil Company for the bulk transport of petroleum products by air into the remote areas of Australia and the central highlands of New Guinea. Carried in the cargo space of DC-3 aircraft, the new tanks replace 44-gal drums and can be collapsed and folded up for the return journeys, leaving the entire cargo space available for the transport of primary produce and general cargo.

These tanks are being used to supply distillate from the Vacuum depot at Wyndham to the inland killing-stations of Air Beef in the Kimberley district in the north-west of Western Australia; and by Mandated Airlines, New Guinea, to supply gasoline from Lae to the Vacuum depot at Goroka.

The company's other activities, as reported in last year's issue, continue at the 35,000 sq ft factory of the aviation division at Bayswater and the main rubber works at Montague and Bayswater.

Fairey Aviation Company of Australasia Pty., Ltd., *(Main plant) P.O. Box 41, Bankstown, N.S.W., and (Special projects division) P.O. Box 85, Salisbury, S.A.*

FOR the Royal Australian Navy, Fairey Australasia have carried out overhaul and modification work on Fireflies, Sea Furies and Gannets; while for the R.A.A.F. similar work on Meteors is on the company's programme. Civil overhaul and conversion (including agricultural conversions), particularly on DC-3s, has been continued.

The Special Projects Division at Salisbury continues to specialize in rocket test-vehicles, instruments and plastics components.

Lucas-Rotax (Australia) Pty., Ltd., *81 Bouverie Street, Carlton, Victoria.*

SIX years ago Joseph Lucas (Australia), Ltd. and Rotax, Ltd., merged into Lucas-Rotax (Australia), Ltd. Previously the Lucas company at Melbourne, which had undertaken the servicing and overhaul of Rotax electrical equipment from 1937, had continued with this work until 1946 when the Australian Rotax company was formed.

Development since 1951 has led to the establishment of factories at Sydney and at Cheltenham as well as Melbourne. The firm is approved by the Australian Department of Civil Aviation for the manufacture, repair, overhaul and modification of Lucas fuel systems and control equipment for gas turbines and Rotax electrical accessories and equipment; and, in addition, for Negretti and Zambra flowmeters, electrical accessories and equipment; fuel, vacuum and hydraulic pumps and associated control gear; ignition apparatus and armature windings. The distributing of Lucas, Rotax, Eclipse, Saunders and Negretti and Zambra products is also performed.

National Instrument Company Pty., Ltd., *Melbourne Airport, Essendon, Victoria.*

A SUBSIDIARY of Australian National Airways, this company continues to apply its experience in aeronautical instruments towards the development of measuring, controlling and electronic instruments for defence projects in the fields of pilotless aircraft and guided missiles. Its overhaul and repair experience gained with instruments for civil airlines has provided the foundation on which to embark on a development and manufacturing programme of considerable magnitude.

N.I.C.'s experimental section has produced prototype instruments which have been successfully flight-tested. Development and manufacture of telemetering, electronic, pressure and temperature indicating and recording instruments continues.

The company acts as sales and service agents for a variety of aircraft communication equipment, including the products of Sperry, Plessey and S. B. Pullin. Workshops are maintained at Sydney, Brisbane, Adelaide and Perth, in addition to the main plant at Essendon.

Normalair (Australia) Pty., Ltd., *Essendon, Victoria.*

THIS company's plant at Essendon is equipped with all necessary test rigs, air blowers, exhausters, etc., to deal with the servicing, maintenance, overhaul and assembly of all Normalair cabin pressurization products.

Also handled are similar products, including refrigeration turbines and air compressors of AiResearch design, an overhaul agreement having been signed between the Normalair and AiResearch companies; and space is available at Essendon for undertaking the repair and overhaul of fuel pumps and other units made by the Self-Priming Pump and Engineering Co.

S. Smith and Sons (Australia) Pty. Ltd., *46-52 Ferndell Street, Guildford, N.S.W.*

THIS company, a subsidiary of the well-known Smiths Aircraft Instruments firm of London, is concerned with the servicing, overhaul and repair of its parent company's products in N.S.W. and Victoria. It has full servicing facilities in Sydney and Melbourne for the overhaul and repair of all civil and military aircraft instruments, automatic pilots and gyro-compass systems. An instrument service and repair facilities are maintained for the R.A.A.F., R.A.N., and civil operators; and test equipment is being developed and manufactured.

At present the company continues to build up know-how on the latest Viscount equipment, particularly on the Smiths S.E.P.2 autopilots currently fitted and operating in Viscounts, and on the latest military version of the same equipment.

Rolls-Royce of Australia Pty., Ltd., *78-86 Kent Road, Mascot, N.S.W.*

THE Rolls-Royce factory at Mascot is fully engaged with the overhaul of Dart turboprop engines operating in the Viscounts of Trans-Australia Airlines, Butler Air Transport, Philippine Air Lines and Hong Kong Airways, in addition to the Avon turbojets installed in the Canberras of the Royal Australian Air Force. With the forthcoming introduction of the Fokker Friendship into Australia, the overhaul work on Darts will increase.

Dart engine-overhaul life in the area dealt with by Rolls-Royce of Australia is now established at 1,400 hr and, at the present time, the factory is dealing with 15 Dart and three Avon overhauls per month. This capacity can easily be extended, however, to cover approximately 24 Darts and four Avons.

Full technical liaison is maintained with all operators of Rolls-Royce engines. A full range of spare parts is maintained for supply to the airlines and an extension to the stores floor-area is to be made to cover the increasing sales of spare parts.

The industrial oil-engine business is now growing steadily and a new test-house is about to be built to cover the testing of all types of oil engines operating in the territory.

An instruction school at Rolls-Royce of Australia is in operation, giving training to the operators' engineers in the maintenance and overhaul of Rolls-Royce engines.

Director and general manager of Rolls-Royce of Australia is W. P. Calvert.

Work on Avons and Darts in the Rolls-Royce factory at Mascot, N.S.W.

Australia's Air Transport

By W. G. BURNS
Dip.C.E., A.M.I.E.Aust., A.F.R.Ae.S.

A Super-G of Qantas, Australia's flag carrier.

THE matter of overriding interest in the Australian domestic airline sphere at the moment relates to the future of Australian National Airways, which is reputed to be the largest private airline in the British Commonwealth. Shipping interests represented in A.N.A., including the U.K. Orient Steam Navigation Company, have evidently been dissatisfied with the annual return on the nominal paid-up capital of £1,500,000. The true capital value of A.N.A. is, of course, well in excess of this figure, as the possession of six DC-6 and DC-6B aircraft indicates.

A.N.A.'s Board proposed to the Cabinet the formation of a holding company in which all Australian airlines, including the government-owned T.A.A., would hold shares in proportion to their capital and would continue in competition. The Cabinet rejected this proposal as incompatible with true competition, and noted that Ansett Airways had made an offer for A.N.A., but that subsequent direct negotiations between A.N.A. and Ansett had not borne fruit. The latest information is that Mr. Ivan Holyman has made an offer to buy the shares of A.N.A. (Holyman Bros. already own 20 per cent) on behalf of a public company yet to be formed, and in which Ansett may take a considerable financial interest.

International Operations. Senator Paltridge announced in July the successful conclusion of negotiations between the U.S. and Australian Governments on the extension of the air transport agreement between the two countries.

The Australian delegation to Washington was led by the Director-General of Civil Aviation, Mr. D. G. Anderson, and the Americans granted rights for Qantas to operate across the U.S.A. from San Francisco to New York, and thence across the Atlantic from New York to any point in Europe. In return, the U.S.A. was granted rights to operate across Australia to South Africa, north to the Philippines and across Antarctica to South America.

This new air agreement is a matter of tremendous importance to Australia, as the air link to the U.K. and Europe is now secured in both easterly and westerly directions. To some extent recent statistics show a shift in traffic for Europe from the Kangaroo route to the Pacific route, and the new rights will enable Qantas to carry its passengers to Europe instead of completing its eastward service at San Francisco.

THE AUTHOR, a civil engineer and commercial pilot, is Civil Aviation Liaison Officer at Australia House, London. This article expresses his private views, and not necessarily those of the Australian Department of Civil Aviation.

It has been suggested in certain quarters that Australia may have paid too heavy a price to the U.S.A. for these rights, but such a statement has little regard for the importance—strategic as well as commercial—of this route to the Commonwealth. Political difficulties in Asia or the Middle East could have serious repercussions on the Kangaroo route (as has happened twice in recent times), and the isolation of Australia from Europe and the U.K. must always be remembered when considering such possibilities. The Australian people will probably now be satisfied with the strong and wholly Australian airline ties which will exist in both directions with the mother country.

A further item of importance and prestige is that Qantas may become the first true around-the-world airline operator, as it is understood that the services to Europe *via* the U.S.A. may begin towards the end of the year, using Lockheed 1049-G Super Constellations.

New Equipment. Like those of most other countries, Australia's airlines are prime targets for the salesmen of new aircraft. The ubiquitous DC-3 is nearing the end of its economic life and competition from new aircraft is spurring operators, however reluctantly, into the consideration of new types.

Trans-Australian Airlines have purchased six Fokker F.27 Friendships with an option on a further six for delivery in 1959. T.A.A. are also interested in the Caravelle [as reported in *Flight* last week] for use on the Adelaide-Perth run, on which the strong prevailing westerly winds necessitate an inconvenient technical stop at Kalgoorlie for a number of Viscount services.

The Department of Civil Aviation also has two Friendships on order for use on airway and navigational aid checking, and for V.I.P. transport.

Left, Australia's busiest airport is Kingsford Smith, Sydney. Right, A.N.A. utilizes each of its DC-6Bs for 12 hours a day.

One of the world's hardest-worked Viscounts: T.A.A. got nine hours a day out of each of their fleet of 11 in 1956.

AUSTRALIA'S AIR TRANSPORT . . .

Australian National Airways are of course pre-occupied with other matters at the moment, but consideration must soon be given by A.N.A. (or their successors) to a DC-3 re-equipment programme, and their deliberations will be watched with considerable interest—particularly by Handley Page, to whom A.N.A. must be a good sales-prospect for Dart-Heralds. And assuming that A.N.A. must enter the turboprop field to keep pace with T.A.A., the prospects of the Vanguard as a successor to the DC-6 and 6B must be very good indeed. One wonders, too, whether Australia, with its reasonably well-ordered airline economics and low fares, should seriously contemplate the introduction of the medium/short range jet transport on domestic services, as distinct from the second generation of turboprops with their undoubted economic advantages. Time will tell.

Ansett buys American, and the airline has recently placed orders for eight Convair 440 Metropolitans and three Lockheed Electras to supplement the present fleet of Convair 340s and DC-3s. Ansett's decision to buy more Convairs was of considerable interest in view of European and U.S. experience of operating Convairs and Viscounts in direct competition, but the Viscount delivery position does not leave an operator much choice if he requires capacity quickly. Ansett may well be interested in an Eland-Convair conversion at a later stage.

Butler Air Transport, following recent internal administrative troubles, has purchased three ex-B.E.A. Airspeed Ambassadors for use on N.S.W. country runs and as a DC-3 replacement. These aircraft have reasonably low total hours and should give many years of service.

A big equipment problem in Australia is a suitable twin-engined 12/20-passenger machine which will be an economic operating proposition, and yet will meet full public transport-category airworthiness requirements with one engine out. Such an aircraft has not yet appeared in the size and at the cost required. The authorities are loath to support requests by small operators for licences to compete in well-developed areas against established ground transport, as many such applications involve aircraft which have suspect single-engine performance in the high-altitude conditions likely to be encountered in country areas. Such aeroplanes may be acceptable for development flying in outback areas, where a certain element of risk may be accepted in the light of the service offered to a given area; but where air transport is not in the pioneering stage it should stand on its own feet with regard to safety. In a phrase, this means full-transport-category single-engine performance. The first aircraft manufacturer to produce such a machine at a reasonable price should uncover a substantial world market, with many sales in Australia.

The Australian market for light U.K. aircraft continues to be good, with the introduction of approximately 40 additional Chipmunks into flying-club training. There have also been sales of the Edgar Percival E.P.9, and of Austers; but the U.K. industry continues to ignore the market for the all-metal light twin and high-performance single-engined aeroplanes. Recent sales of the Cessna 180 and Piper Apache show that an Australian market exists for machines of this calibre, in spite of their price.

T.E.A.L., the jointly owned Australian-New Zealand airline, is also about to re-equip for the service across the Tasman Sea, and the recent overseas mission of chief engineer Bolt and assistant general manager Reeves announced on its return to Auckland that it would recommend the purchase of Convair 880 aircraft, which would seem superficially to be tailored to this route. Subsequently Sir Leonard Isitt, chairman of T.E.A.L., said that no definite decision had been made, and that seven types—jet and turboprop—were being studied.

An interesting purchase of aircraft in the last year was the acquisition in Sweden of three Junkers Ju-52s by Gibbes Sepik Airways for use in New Guinea. Pratt and Whitney engines and variable-pitch D.H. propellers were fitted in Stockholm and the aircraft were flown to New Guinea earlier this year.

Ground Facilities. With its comparatively small population (9.45 millions) and limited budget Australia is always faced with the problem of developing its continent. The air transport industry provides a logical method, but the big problem to be faced is the provision of sufficient aerodromes and ground facilities to satisfy the pressing needs.

Dr. K. N. E. Bradfield, Director of Airports in D.C.A., recently stated that funds in the order of £A30,000,000 were needed to develop airports to a satisfactory standard to handle existing traffic and the increases expected in the next few years. Current total expenditure on aerodromes is of the order of £A2,500,000 per annum, which is less than the cost of the new Darwin runway, and Dr. Bradfield suggested that a revision be made of the present procedures of development, and that local authorities should be encouraged to own and administer their own aerodromes with Federal help.

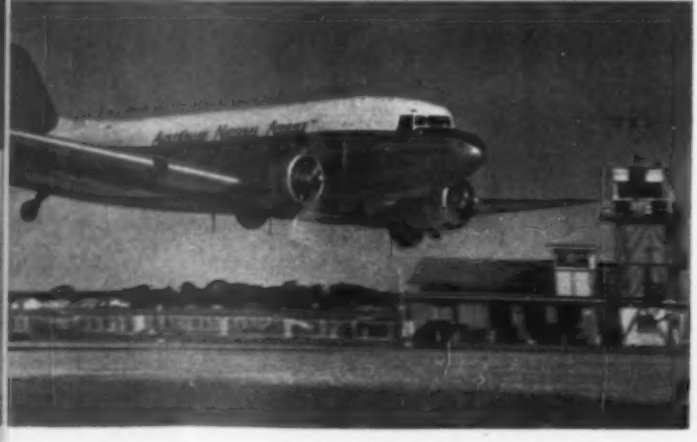
Plans are in hand for the building of a new overseas terminal area at Sydney airport, and new instrument runways at Brisbane and Darwin are nearing completion. One project in which Australia has a vital interest is the development of a jet-transport class runway at Nandi, Fiji, by mid-1959 to enable the Qantas Boeing 707/138 to be introduced on the Pacific run and beyond. Qantas will be the first non-U.S. airline to receive the Boeing jets.

On the A.T.C. front, an order has been placed with Cossor Radar, Ltd., for the mid-1958 supply of two Type 21 surveillance radar units for use in Sydney and Melbourne to monitor the area and approach control aspects of the A.T.C. organization at these centres.

The 200 Mc/s double-pulse D.M.E. installations in Australia have been an unqualified success and enthusiastic airline pilots are continually discovering new ways in which the spreading network can be used. The D.C.A. has introduced new descent procedures and revised separation requirements for aircraft using D.M.E., and the equipment may shortly be related to I.L.S. approaches by locating the station on the airport near the approach end of the instrument runway.

The A.T.C. centre at Melbourne Airport handled 247 aircraft on the eve of the Olympics, with a peak of one movement every 2.2 minutes for an hour. To assist in controlling the traffic an R.A.A.F. G.C.A. unit was pressed into service for area surveillance and talk-down purposes.

Conclusion. The regular rate of growth of Australian civil aviation, and the immense task ahead of developing a new continent, suggests a stable period of steady progress for the air transport industry, and Australia is fortunate in having young aviation administrators of very high calibre. With enthusiastic direction and firm Government support the future looks bright.



For many years the DC-3 has been the main tool with which Australia has opened up its vast territories. Here is one of A.N.A.'s fleet of 14.

India

HINDUSTAN AIRCRAFT (PRIVATE) LTD.,

Bangalore, India.

TURBOJETS, fighters and trainer aircraft are now included in the production programme of Hindustan Aircraft. Support in the expansion of the company's activities has come from the Indian Defence Ministry, in an endeavour not only to provide employment but also to make the country self-sufficient in certain important spheres.

In September last year the Government of India concluded an agreement with the Bristol Aeroplane Company under which India obtained a licence to manufacture the full range of Bristol Orpheus turbojets. Licence negotiations have also been concluded with the Folland Company for the manufacture by Hindustan Aircraft of the Gnat light fighter. Several of the company's engineers are now in the U.K. familiarizing themselves with production aspects of both the Gnat and the Orpheus, and specialists from the British companies will assist in training the Indian personnel in all aspects of production and planning. Construction of Hindustan Aircraft's engine factory is progressing rapidly and the first Indian-built Orpheus is expected to be available for the Gnat during India's second five-year plan period.

The design and development organization of H.A.L. has been expanded and a design team led by the eminent German aircraft designer, Dr. Kurt Tank, has been engaged. The factory has now been reorganized into three divisions, devoted to aircraft manufacture and overhaul, engine manufacture and railway coach production. One of the largest aircraft repair, manufacturing and overhaul organizations in the East, Hindustan Aircraft is a member of the S.B.A.C. and its plant has been approved by the American C.A.A. for the repair and overhaul of U.S. aircraft and engines.

Since the company began the repair and erection of Indian Air Force Tempest fighters in 1947, the factory has undertaken most of the subsequent Air Force requirements. Hindustan-built Vampire fighters and trainers form an important part of today's I.A.F. fleet. On the maintenance side, there has been a steady expansion, particularly since the attainment of India's independence ten years ago and the expansion of the I.A.F.

During the last few years a modern foundry has been developed and has produced commercial and high-stress light-alloy castings for aircraft. Both aluminium and magnesium alloys are produced entirely at the company's works. This foundry is also producing high-grade cast-iron castings to meet the production requirements of Hindustan Machine Tools, a sister concern owned by the Government. A new development is the introduction of light-alloy forgings, for which machinery is now being installed.

Mrs. Vijayalakshmi Pandit, Indian High Commissioner in the United Kingdom and Sir Reginald Verdon Smith, chairman of the Bristol Aeroplane Company, signing in London the agreement under which India obtained the licence to manufacture the Bristol Orpheus.

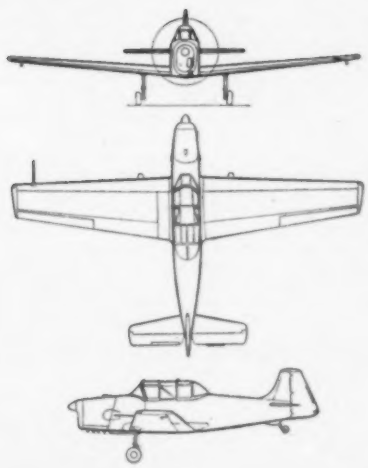
The Indian Navy is now operating three HT-2 trainers, and the Indian Government has donated a further HT-2 to Singapore, under the Colombo Aid Plan, for the training of pilots and engineers. For the future, a demonstration tour of Australia and New Zealand by the HT-2 is planned.

The first aircraft to be designed and produced in quantity in India, the HT-2 is an efficient basic trainer powered by a 155 h.p. Cirrus Major III engine. It is of all-metal construction and has a cruising speed of 115 m.p.h. Stalling speed with 30 deg flap is 47 m.p.h., and the initial rate of climb is 80 ft/min. Other data include: span, 35ft 2in; length 25ft 3in; gross weight 2240 lb; maximum speed 130 m.p.h.

Among the board of management of the company are J. M. Shrinagesh, general manager; A. Zampolino, factory manager; P. M. Reddy, deputy general manager (engines); S. L. Sazena, deputy general manager (railcoach); Dr. Kurt Tank, director of engineering and Dr. V. M. Ghatage, chief designer.

Hindustan Aircraft's Sealand hangar, where overhaul work for the Indian Navy is carried out. Other work has included production for both Navy and Air Force.

Among the year's visitors who have inspected the HT-2 trainer (general-arrangement drawing, lower left) were the Shah and Empress of Iran.



Servicing of Devon aircraft of the R.N.Z.A.F. on the tarmac in front of the de Havilland company's premises at Rongotai, Wellington.

New Zealand

NEW equipment for the vigorous industry of aerial agriculture has been introduced to New Zealand during the past year in the shape of the Auster Agricola and the Edgar Percival E.P.9. These aircraft have joined the numbers of Tiger Moths, Fletcher FU-24s and other adapted aircraft types which have built up New Zealand's premier position in this operating field—and particularly in the techniques of top-dressing—in the post-war years.

On the manufacturing side, there remains no construction of complete aircraft in New Zealand at present. The assembly of "knocked-down" all-metal Fletcher FU-24s by New Zealand companies continues, while no plans for local manufacture of either of the new British agricultural aircraft have yet been announced. Among the major companies on the New Zealand aviation scene are those whose current activities are noted on this page.

Bristol Aeroplane Company (New Zealand), Ltd., *113 Willis Street, Wellington C.1.*

SALES and technical representation of the Bristol Aeroplane Company are the functions of the New Zealand Bristol organization, which has no aircraft overhaul or repair facilities. Other manufacturers represented in New Zealand by the company include Rotol, Shorts, Auster, Auto Diesels and Redifon. During the past twelve months, the appearance of the Auster Agricola in New Zealand has been a major development.

Cable-Price Corporation, Ltd., *166 The Terrace, Wellington.*

THE aviation division of this company has continued to import Fletcher FU-24 agricultural aircraft in "knocked-down" condition from the U.S.A. during the past twelve months. A 240 h.p. engine, introduced in the FU-24 this year, has given a much-improved efficiency compared with the previous 225 h.p. version. Special fittings for the new engine have been produced locally. The company is investing time and money in further research on aerial spraying equipment.

The de Havilland Aircraft Company of New Zealand, Ltd., *Rongotai Aerodrome, Wellington, E.4.*

SERVICING, maintenance and overhaul of aircraft and engines of the Royal New Zealand Air Force is a major commitment of the company, which also provides overhaul and servicing facilities for the aircraft used in agricultural rôles in New Zealand. Other overhaul facilities provided are those for flying clubs and commercial operators.

For the future, an expansion of premises and facilities, to cater for the growing New Zealand aircraft industry, is probable. General manager of the company is J. A. Kerr.

Electronic Navigation, Ltd., *P.O. Box 1905, Auckland.*

THIS company is a specialized aviation supply house serving the aviation industry throughout New Zealand. The company is a subsidiary of Australian National Airways and is associated with Aviation and Engineering Supplies, Melbourne; National Instrument Co., Melbourne; Kindred Aviation, California; and Airmotive Supply Corporation, Dallas. Close contact has been maintained with all overseas suppliers throughout the year and further expansion is contemplated in the coming year.

James Aviation, Ltd., *P.O. Box 662, Hamilton and P.O. Box 399, Rotorua.*

FINAL assembly and fuselage construction of the Fletcher FU-24 agricultural aircraft imported by Cable-Price is carried out by the James company at Rukuhia Aerodrome, Hamilton, the company's main base. A second base is located at Rotorua Aerodrome, and the company's facilities include those for helicopter maintenance. The company also has an active fleet of aircraft engaged on agricultural and other aerial work.

Tasman Empire Airways, Ltd., *P.O. Box 2201, Auckland.*

SITUATED at Mechanics' Bay, Auckland, and Whenuapai Airport, T.E.A.L. provide complete overhaul and maintenance facilities for British and American aircraft and components. These facilities include 54,000 sq ft of hangar space and 80,000 sq ft of workshops. In the Fletcher FU-24 programme, the company assembles the wings and other components.

Other current work includes the overhaul and maintenance of DC-6 aircraft and Solent flying-boats of the company's own fleet, plus Sunderlands, Bristol Freighters and Hastings of the R.N.Z.A.F. Line maintenance of DC-6B aircraft for C.P.A.L. and T.A.I. is carried out and, on the engine side, the overhaul and servicing of Pratt and Whitney engines, Hercules engines, de Havilland and Hamilton Standard airscrews. Servicing of components is also performed. General manager and chief executive of T.E.A.L. is G. N. Roberts, C.B.E., A.F.C.

Interior view of the Tasman engineering building at Mechanics' Bay.

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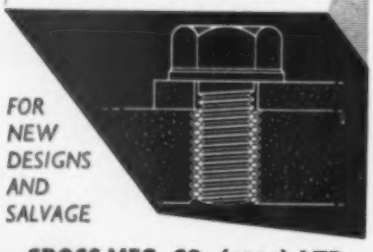

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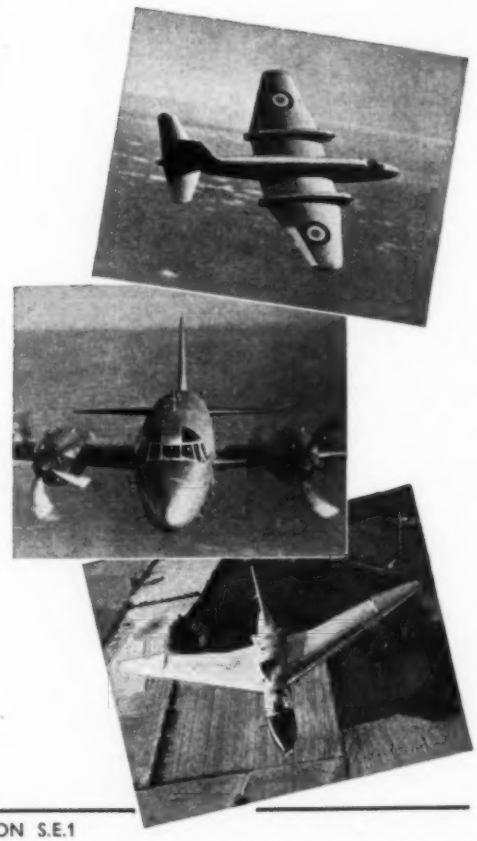

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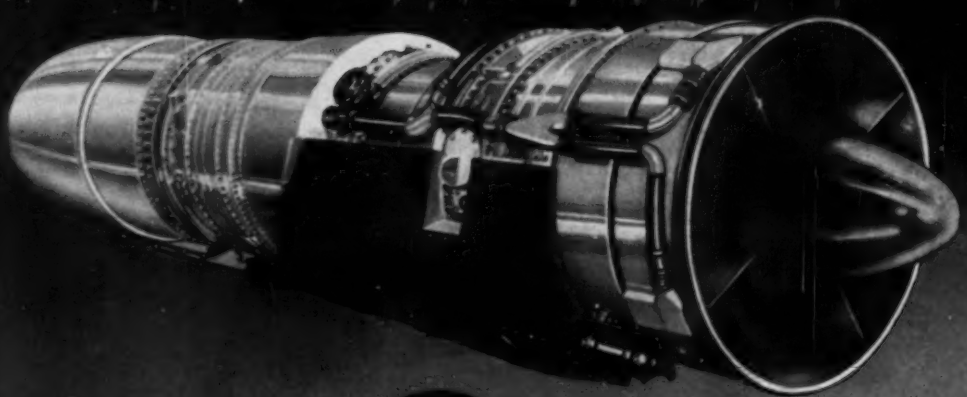
FLIGHT TESTING THE NEW IROQUOIS AT MALTON



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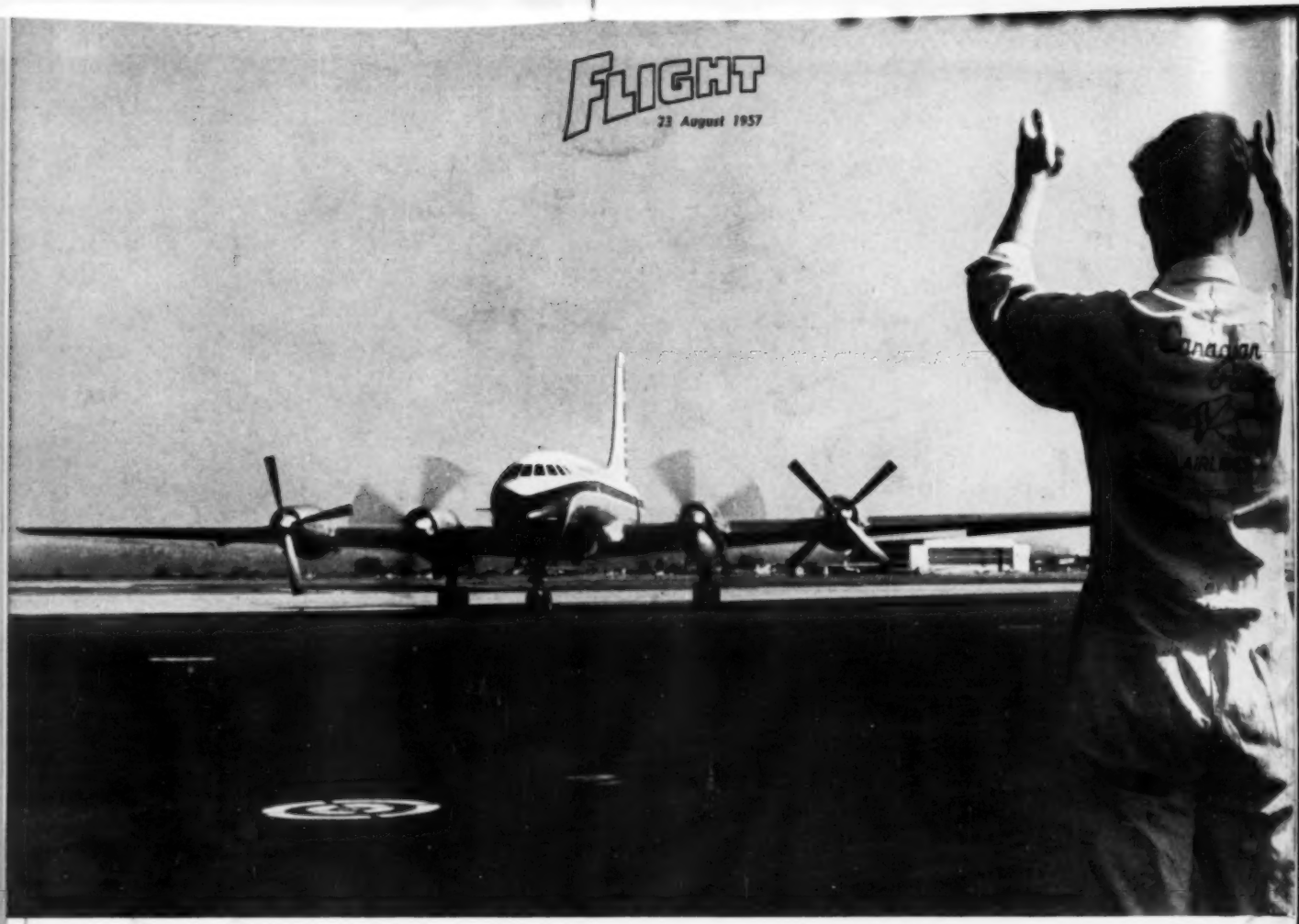

BRITANNIAS WILL BRING NEW LOOK TO CANADIAN PACIFIC AIR ROUTES

Canadian Pacific Airlines to introduce world's biggest, fastest, quietest airliner to trans-polar and inter-continental air routes early next year

The Bristol Britannia, the world's biggest, fastest and quietest airliner is coming into service on Canadian Pacific air routes early next year. These magnificent new aircraft will bring new standards of speed and luxury to Canadian Pacific passengers, flying over the North Pole on European routes, to and from South America and across the Pacific to Tokyo and Sydney.

Britannias are in commercial service with British Overseas Airways Corporation. They have also been ordered by Aeronaves de Mexico, Cubana de Aviacion, El Al Israel Airlines, Hunting-Clan Air Transport, Northeast Airlines, Royal Air Force Transport Command, and the Ministry of Supply.

Two Britannia derivatives now building in Canada will also give a new look to the Royal Canadian Air Force. These are the long range maritime reconnaissance CL28 Argus and the military transport CL44, both built by Canadair Ltd. The CL44 will be powered by Bristol Orion supercharged turboprop engines.

BRISTOL
Britannia

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